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# THE GEOMORPHOLOGY AND GEOLOGY OF CALHOUN COUNTY, FLORIDA

BY

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# The geomorphology and geology of Calhoun County, Florida

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## GEOMORPHOLOGY

Calhoun County is situated in the Northern Zone geomorphic province of White (1970). In this portion of the east-central Florida panhandle, the Northern Zone is divided into four geomorphic subzones based largely on topographic elevations. These include the Gulf Coastal Lowlands, Fountain Slope, New Hope Ridge, and Grand Ridge.

The Gulf Coastal Lowlands (Figure 1) comprise much of the lower half of Calhoun County. This subzone is characterized by a generally flat and often swampy, seaward sloping, sandy plain. Most of the lowlands area is ancient marine terrace, shaped by high-standing Pleistocene seas. Elevations in the Gulf Coastal Lowlands of Calhoun County range from between 25 and 65 feet above mean sea level (MSL) at the southern edge of the county to approximately 100 feet above MSL where the lowlands meet the higher ridges to the north in mid-Calhoun County.

Three topographically-higher subzones are present in northern Calhoun County: the Fountain Slope, the New Hope Ridge, and the Grand Ridge. Fountain Slope was the name given by White et al. (1964) to a ramp-like, northward-rising topographic slope separating the Gulf Coastal Lowlands and the New Hope Ridge (Figure 1). The elevations of this feature range from approximately 100 feet above MSL at its southern edge, adjacent to the coastal lowlands, to about 180 feet above MSL to the north where it meets the New Hope Ridge.

The New Hope Ridge (White et al., 1964) occupies northwestern Calhoun County, west of the Chipola River. It is separated from the elevationally-similar Grand Ridge (White et al., 1964) in eastern Calhoun County by the Chipola River valley. Both ridges are believed to be stream-incised remnants of a once continuous highland spanning north Florida from the Alabama line eastward to Putnam County. The New Hope and Grand Ridges are topographically high, with elevations generally varying between 150 and 250 feet

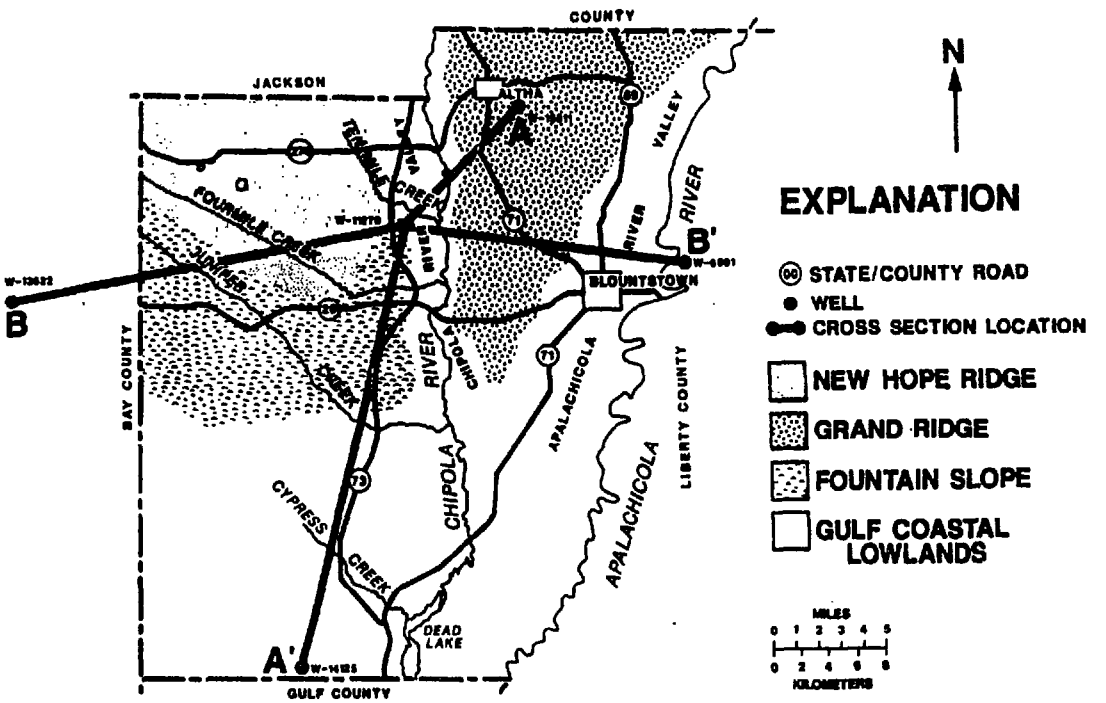


FIGURE 1. Calhoun County location map.

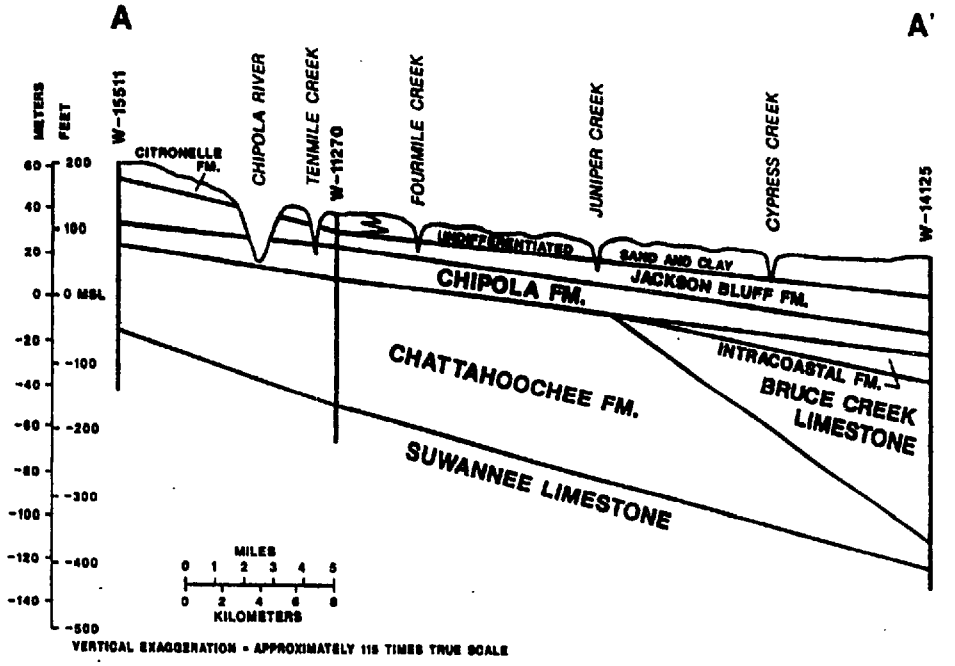


FIGURE 2. Geologic cross section A-A'.

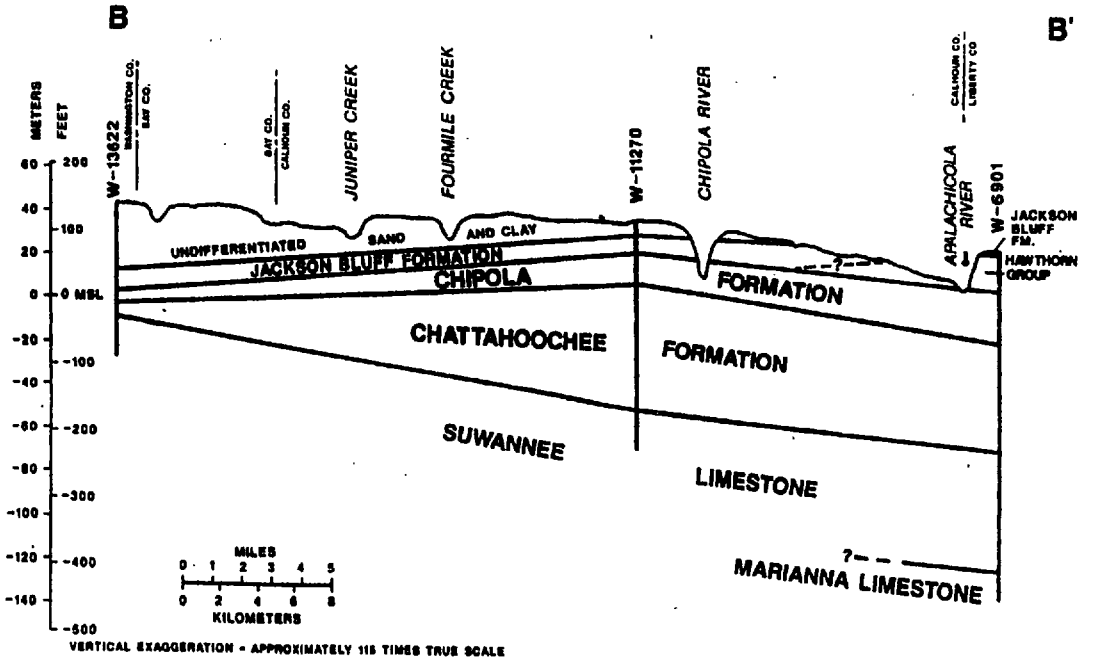


FIGURE 3. Geologic cross section B-B'.

above MSL. Both are comprised of resistant clayey-sands overlying limestone. Several collapse depressions and sinkhole lakes present on the New Hope Ridge belie the karstic nature of the underlying limestone.

The Apalachicola and Chipola Rivers are the major streams flowing in Calhoun County. The Apalachicola River forms the eastern Calhoun County boundary with adjacent Liberty County. In northeast Calhoun County, the broad Apalachicola Valley averages about 50 feet MSL in elevation. It forms a divide between the bluffs of the Tallahassee Hills to the east in Liberty County and the topographically lower, gently-rolling hills of the Grand Ridge. The river meanders southwestward through a three-mile wide valley, which descends to an elevation of about 25 feet above MSL at the southern edge of Calhoun County.

The Chipola River flows southward through east-central Calhoun County, and forms Dead Lake near the southern county boundary. In places the river is well incised, and in northern Calhoun County, exposes Miocene limestones and Pliocene shell beds along its course. Several smaller surface streams contribute to the Chipola River. Tenmile Creek, Fourmile Creek, and Juniper Creek form a southward succession of well-incised, northwest-southeast trending tributaries entering the Chipola from the west. These creeks may define a parallel series of relict beach ridge systems. In southern Calhoun County, Cypress Creek drains several low, swampy areas and ultimately empties into Dead Lake.

## GEOLOGY

Calhoun County is underlain by hundreds of feet of marine limestones, dolomites, sands, and clays. The oldest rocks recovered by well drilling in the county were Mesozoic Erathem, Cretaceous System (140 to 65 million years old) marine sedimentary rocks, at depths of approximately 2,800 to 5,000 feet below land surface (bls) (Florida Geological Survey unpublished well logs). Petroleum test wells in nearby Gulf County, however, reveal the presence of older Paleozoic Erathem (500 to 250 million years old) basement rocks lying at depths in excess of 12,000 feet bls; similar rocks probably occur beneath Calhoun County as well. The youngest sediments present in the county are Pleistocene and Holocene (1.8 million years old to recent) alluvium and marine terrace sands and clays.

The Mesozoic Erathem rocks and early Cenozoic Erathem (Paleocene and Eocene Series, 65 to 38 million years old) rocks underlying Calhoun County are largely marine carbonates lying at depths penetrated only by deep oil test wells. Most water wells in Calhoun County draw from Oligocene and Miocene (38 to 5 million years old) strata at depths of 500 feet or less bls. These rocks function as the important freshwater aquifers for the region. For the purposes of this report, the discussion of the stratigraphy of Calhoun County will be limited to these Oligocene and younger sediments. Figure 1 shows the geologic cross-section locations, and Figures 2 and 3 illustrate the shallow stratigraphy of Calhoun County. Most of the geologic data cited in this study is taken from Schmidt (1984), Puri and Vernon (1964), and from Florida Geological Survey well log files.

### Oligocene Series
### Marianna Limestone

The Marianna Limestone (Matson and Clapp, 1909) is the oldest unit penetrated by the cores used in this report. It consists of a gray to cream, chalky, fossiliferous marine limestone frequently containing large, coin-shaped Lepidocyclina foraminfera fossils. The Marianna Limestone is considered to be Lower Oligocene (38 to 33 million years old). This unit was penetrated in only one core used in this study (W-6901, Liberty County - see Figure 3), and the extent of its occurrence under Calhoun County is uncertain due to a general lack of well coverage. It probably underlies eastern and northern Calhoun County at depths of 400 to 500 feet bls. The Marianna Limestone is overlain by sediments of the Upper Oligocene Suwannee Limestone.

### Suwannee Limestone

The Suwannee Limestone (Cooke and Mansfield, 1936) is an Upper Oligocene (33 to 25 million years old) light gray to yellowish-gray, well-indurated, often dolomitized, marine limestone. It typically contains abundant fossils including foraminifera, mollusks, and echinoids. Depth to the Suwannee Limestone ranges between 350 and 460 feet bls in Calhoun County. Thickness of the unit is variable, and usually exceeds 100 feet. It generally dips and thickens to the southeast into the trough of the Apalachicola Embayment. The Suwannee Limestone is a component of the Florida aquifer system,

and this unit supplies deep municipal water wells in the county. It unconformibly overlies the Oligocene Marianna Limestone or Eocene Ocala Group carbonates. In much of central and northern Calhoun County, it is overlain by Miocene sediments of the Chattahoochee Formation. The overlying Chattahoochee Formation grades laterally into the Bruce Creek Limestone near the southern edge of the county.

### Miocene and Pliocene Series
### Chattahoochee Formation

The Lower Miocene (25 to 20 million years old) Chattahoochee Formation (Dall and Stanley-Brown, 1894) overlies the Suwannee Limestone in Calhoun County. The Chattahoochee Formation is generally a very pale orange to white or light gray, often quartz sandy, phosphoritic, dolomitic marine limestone. In some cases, post-depositional ground water alteration of the carbonates in portions of the central and western panhandle has made differentiation of the Chattahoochee Formation from the underlying Suwannee Limestone and overlying Bruce Creek Limestone difficult or impossible. Where defineable in Calhoun County however, the top of the Chattahoochee Formation varies from about 100 feet to 420 feet bls. Thickness ranges from approximately 185 feet in the central portion of the county to less than 50 feet in western and southern Calhoun County. As with the underlying Suwannee Limestone, the Chattahoochee dips to the east-southeast, grading into or interfingering with the Bruce Creek Limestone along the southern edge of Calhoun County. The Chattahoochee Formation is a unit of the Floridan aquifer system, and rural Calhoun County wells draw from this formation. Along the southern edge of the county, the Bruce Creek Limestone grades into the Chattahoochee Formation (Figure 2). In northern Calhoun County, the Bruce Creek Limestone is absent, and the Chattahoochee Formation is overlain by sediments of the Middle Miocene Chipola Formation.

### Bruce Creek Limestone

The Middle Miocene (17 to 10 million years old) Bruce Creek Limestone (Huddlestun, 1984) is a white to yellowish-gray, fossiliferous, calcarenitic, marine limestone underlying the southern half of Calhoun County. It is often highly microfossiliferous, molluscan moldic, and in some areas, dolomitic. From mid-Calhoun County, this unit thickens and dips rapidly towards the south, into the trough of the Apalachicola Embayment (Figure 2). The Bruce Creek Limestone varies in depth from approximately 100 feet bls at its northern limit in central Calhoun County to over 400 feet bls in the southern portion of the county. Its thickness increases rapidly from zero in the central part of the county southward to nearly 200 feet near the Calhoun-Gulf county line. The Bruce Creek Limestone comprises the uppermost unit of the Floridan aquifer system in Calhoun County. Where present, it is overlain by the Middle Miocene Intracoastal Formation.

### Intracoastal Formation

The Intracoastal Formation (Huddlestun, 1984; Schmidt and Clark, 1980) is comprised of a yellowish-gray, abundantly microfossiliferous, sandy, poorly-indurated, marine limestone. It spans an age range of Middle Miocene to Upper Pliocene (17 to 2 million years old). Like the underlying Bruce Creek Limestone, the updip limit of the Intracoastal Formation occurs along a west-to-east line across central Calhoun County. The formation is absent north of Blountstown. It thickens and dips to the south-southeast, approaching 60 feet in thickness at the southern edge of the county. Depth to the top of the unit in Calhoun County is highly variable, generally averaging about 100 to 150 feet bls. Throughout its extent in Calhoun County, the Intracoastal Formation is overlain by the Chipola Formation.

### Chipola Formation

The Chipola Formation (Burns, 1889) is a Middle Miocene carbonate unit underlying most of Calhoun County. It is typically comprised of a yellowish-gray to light gray, moderately-to-well induarated, quartz sandy, marine limestone or marl. The Chipola Formation approaches the surface in central and northern Calhoun County, where it is, in places, covered only by a thin veneer of Jackson Bluff Formation or undifferentiated surficial sediments. It is locally exposed along the banks of Tenmile Creek and along portions of the Chipola River, the type area for the formation. Here it commonly contains abundant fossil mollusks. In western and southern Calhoun County, the top of the Chipola Formation dips to nearly 100 feet bls. The Chipola Formation is overlain by sediments of the Upper Pliocene Jackson Bluff Formation.

### Jackson Bluff Formation

The Upper Pliocene (3 to 1.8 million years old) Jackson Bluff Formation (Puri and Vernon, 1964) is predominantly comprised of light gray to olive gray, poorly-consolidated, clayey quartz sands and sandy shell beds. It overlies the Chipola Formation in Calhoun County. In the high bluffs across the Apalachicola River from northeastern Calhoun County in Liberty County, the Jackson Bluff Formation rests on Miocene Hawthorn Group deposits (Figure 3). The Jackson Bluff Formation is a thin unit, averaging less than 50 feet thick in eastern Calhoun County. It dips and thickens to the south, reaching a maximum thickness of about 50 feet in the southern part of the county. Depth to the top of the Jackson Bluff is variable throughout the county. It crops out locally along the Apalachicola and Chipola Rivers, and is closest to the surface in northeastern Calhoun County, where it is overlain by 20 to 25 feet of Citronelle Formation sediments. In the western portion of the county, it approaches a depth of 80 feet bls, and is covered primarily by undifferentiated sands and clays. Along the southern edge of Calhoun County, the Jackson Bluff is overlain by approximately 50 feet of undifferentiated sands.

### Citronelle Formation

The reddish, clayey, coarse quartz sands and gravels of the Upper Pliocene Citronelle Formation (Matson, 1916) blanket large areas of the northern half of Calhoun County. Believed to be of fluvial origin, the characteristic Citronelle Formation sediments are comprised of cross-bedded sands, gravels, and clays. Portions of the Calhoun County surficial deposits may represent reworked and redeposited Citronelle sediments, transported from the eroding highlands to the north. Thickness generally varies between 20 and 80 feet, and the Citronnelle deposits comprise the surficial sediments in their area of occurence. Within Calhoun County, the Citronelle Formation sediments grade laterally into a series of undifferentiated quartz sands and clayey sands.

### Plio-Pleistocene and Holocene Series Undifferentiated Sand and Clays

Much of the southern half of Calhoun County is covered by surficial quartz sands, clays, and clayey sands. Due to the massive and discontinuous nature of many of these units, they are lumped together as undifferentiated deposits. These deposits represent a mixture of marine and fluvial clastics associated with Pleistocene (1.8 million to 10,000 years old) sea level highstands and the prograding Apalachicola delta. The modern soil profiles probably evolved during the Late Pleistocene and Holocene (10,000 years ago to present). Holocene alluvium, in the form of river-borne clays and sand, are deposited along the banks and bars of the Apalachicola River in eastern Calhoun County.

## GROUND WATER

Ground water is water that fills the pore spaces in subsurface rocks and sediments. This water is derived principally from precipitation within Calhoun and adjacent counties. The bulk of Calhoun County's consumptive water is withdrawn from ground water aquifers. Three main aquifers are present under Calhoun County. In order of increasing depth, these are the surficial aquifer system, the intermediate aquifer and confining system, and the Floridan aquifer system. Data on aquifer extent and thicknesses are taken from Scott et al., 1990 (in preparation).

### Surficial aquifer system

The surficial aquifer system is the uppermost freshwater aquifer in Calhoun County. This non-artesian aquifer is largely contained within the undifferentiated sands and the Citronelle Formation sediments. It is present in the northeastern part of Calhoun County, where it reaches thicknesses of 55 feet, and trends southward through the middle of the county, adjacent to the Chipola River. In parts of central Calhoun County it is nearly 70 feet thick. It is absent or sporadic in occurence in eastern and western portions of the county. The surficial aquifer system is unconfined, and its upper surface is the water table. In general, the water table elevation fluctuates with precipitation rate and conforms to the topography of the land surface. Recharge to the aquifer is largely through rainfall percolating through the loose surficial sediments, and to a lesser extent, by upward seepage from the underlying intermediate aquifer system. The surficial aquifer is not used extensively as a water source in the county.

### Intermediate aquifer and confining system

The intermediate aquifer system underlies the

surficial aquifer system in Calhoun County, and is largely contained within the Intracoastal, Chipola and Jackson Bluff Formations. Permeable beds within the intermediate aquifer system vary considerably in thickness over the areal extent of the aquifer. In general, the aquifer ranges from 50 to 200 feet in thickness under Calhoun County, corresponding to the variable thicknesses of the geologic formations containing it. The top of the intermediate is also highly variable, dipping from a low of about 20 feet bls in north-central Calhoun County to over 70 feet bls in the western part of the County. Some rural wells draw from this unit, but the intermediate aquifer system is not widely used as a potable water source in this area. Low-permeability beds in the basal intermediate aquifer system may locally function as confining units to the underlying Floridan aquifer system.

### Floridan aquifer system

The Floridan aquifer system is comprised of hundreds of feet of Eocene through Miocene age marine limestones, including the Ocala Group, the Suwannee Limestone, and where present, the Chattahoochee Formation and Bruce Creek Limestone. It is the principle source of municipal drinking water in Calhoun County. The Floridan aquifer system occurs as an artesian aquifer under the entire county. Surface springs tapping this aquifer are absent in Calhoun County. Most recharge to the Floridan aquifer system occurs in small, scattered areas in the northern part of the county, at the up-dip portions of the carbonate units comprising the aquifer. Here, overburden to the Floridan aquifer system is thinnest, and recharge occurs on a low to moderate level. Much of the regional recharge occurs further to the north in Jackson County where the Floridan aquifer system strata crops out at the surface.

## MINERAL RESOURCES

The principal mineral resources occurring in Calhoun County are sand, clay, limestone, and phosphate. The following discussion summarizes the current mining potential of each commodity in the county.

### Sand

A number of shallow private pits in Calhoun County are worked for local fill sand. Pleistocene marine terrace sands and alluvium and Pliocene Citronelle Formation sediments contain quartz sand with varying amounts of clay matrix. These deposits blanket much of the county. Since there is insufficient local demand for sand products, the potential for commercial mining is low at present.

### Clay

Localized deposits of clay and sandy clay are also associated with the undifferentiated Pleistocene and Holocene marine terrace deposits, Holocene alluvium, and Citronelle Formation sediments. Most of these clays are contained in and interbedded with other sediments, and as a result are relatively impure.

Flood-plain clay deposits along the Apalachicola River have been utilized for brick-making in Calhoun County. The Guilford Brothers Brick Company plant, located south of Blountstown, manufactured common brick in the 1920's which was used in the construction of the Blountstown Post Office (Bell, 1924). Bell (1924) cited other potential uses for this clay, including face brick, drain tile, flower pots, and hollow blocks. Reserve estimates of the clay deposits in Calhoun County have not been made, and future exploitation will be largely dependent upon local market demand.

### Limestone

Impure Miocene limestones occur at depth under most of Calhoun County. Most of the shallower units contain extensive impurities, including quartz sand. Due to the presence of these impurities, the overburden thickness (at least 50 feet in northern Calhoun County), and the presence of easily-accessible limestone deposits at the surface in nearby Jackson County, it is unlikely that limestone will ever be an economical commodity in Calhoun County.

### Phosphate

Many of the Miocene formations underlying Calhoun County contain variable percentages of phosphate sand and granules. Most quantities are well below the ecomonic minimum percentage however. In addition, most phosphate-bearing strata occur at depths in excess of 50 feet. These factors preclude a high mining potential for phosphate in Calhoun County.

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