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Secretary



OPEN-FILE MAP SERIES 111, Plate 3
GEOMORPHOLOGY, SPRINGS, AND KARST FEATURES OF THE USGS
BARTOW 30 X 60 MINUTE QUADRANGLE, CENTRAL FLORIDA
2019
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Barrier Island District

The Barrier Island District, characterized by beach ridges, dunes, and relict lagoons, extends into Florida from Georgia, southward to the vicinity of Lake Okechobee (Figure 3). Elevations of the Barrier Island District range from sea-level to just over 300 feet (91.4 meters) above mean sea-level (MSL). Elevations in the Bartow quadrangle portion of the district range from five feet (1.5 meters) to 150 feet (45.7 meters) above MSL. Beach-ridge plains occur in several of the provinces in the district. Elevations of these beach-ridge plains range from sea level in the Atlantic Coastal Complex to about 135 feet (41.1 meters) above MSL. Drainage in the district is strongly controlled by the relict beach ridges, forming distinct trellis drainage. Of the eight provinces in the district, only the Osceola Plain and Bombing Range Ridge are present in this study area. While modern coastal processes are dominantly erosional, with net littoral and longshore transport from north to south, there are many older depositional coastal features in the mapped area. Beach-ridge plains and shore-parallel dunes represent the preserved depositional features of former shorelines. The swales between beach ridges are often swampy and contain many lakes, extensive linear swamps and wetlands, and tributary streams. In the Barrier Island District, relict lagoons are dissected by two major rivers, the St. Johns River and the Kissimmee River. A relict lagoon in the Upper St. Johns River Valley extends uninterrupted from the southern end of the district to southern Volusia County (Figure 4). While (1970) recognized a relict lagoon, now occupied by the Kissimmee River, on the western Osceola Plain. The entire Osceola Plain is underlain by undifferentiated Tertiary/Quaternary marine shelly sediments, which supports the lagoon hypothesis. These rivers also largely follow trellis drainage patterns consistent with coastal depositional landforms. Cypresshead Formation, undifferentiated Quaternary sediments, or regions geographically interpreted as Quaternary beach ridge and dune dominate the surficial geology over much of the Barrier Island District (see OFMS 111, Plate 1). These lie unconformably on units ranging from the Avon Park Formation to the Hawthorn Group (Scott et al., 2001). Sinkhole activity is rare in the district. Where observed, it is typically related to dissolution of shell concentrations, particularly mollusks, near the land surface (Upchurch et al., 2015). These are usually expressed as shallow (a few feet, about one meter) cover-settlement features which may form where the undifferentiated Tertiary/Quaternary shelly sediments are present.

Osceola Plain

The surficial geologic units exposed on the Osceola Plain are undifferentiated Tertiary/Quaternary shelly sediments, undifferentiated Quaternary sediments, and Quaternary beach ridge and dune sediments, the latter covering approximately the eastern quarter of the province. Although the Cypresshead Formation occasionally occurs in the subsurface along the western edge of the province, undifferentiated Tertiary/Quaternary shelly sediments are most common beneath the surficial quartz sands. In the Bartow quadrangle, these overlie Peace River and Arcadia formations (Hawthorn Group) as these units thicken to the south. Both the Ocala Limestone and Avon Park Formation underlie the Hawthorn Group and become more deeply buried from north to south in the province (see OFMS 111, Plate 2). These formations appear to have the most impact on karst landforms in the northern part of the province, near many of the largest lakes where sediments of the Hawthorn Group are relatively thin. Although the province has the topographic form of a terrace, it is unlikely that it is related to one single stand of sea level (White, 1970). Most of the terrain is relatively flat, with about 80% of elevations falling between 50 and 75 feet (15.2 and 22.9 meters) above MSL. Elevation and local relief increase to the north of the Bartow quadrangle where the Econfichutchee River and other tributaries of the St. Johns River are more developed and incised than other drainages in the province. Elevations within the province range from five feet (1.5 meters) to 120 feet (36.6 meters) above MSL and 35 feet (10.7 meters) to 98 feet (29.9 meters) above MSL in the Bartow quadrangle. The Kissimmee River drains much of the western portion of the Osceola Plain southward to Lake Okechobee and the Everglades. The eastern portion of the province is a beach-ridge plain with subtle ridges and swampy swales characterized by trellis drainage. Many of the streams flowing east to the St. Johns River run perpendicular to the ridges, but some segments and tributaries exhibit trellis drainage. Karst features are not common in the part of the province present in the Bartow quadrangle, although shallow sag ponds occur. These are cover-settlement features and likely exist due to dissolution of thinly buried concentrations of shell material, primarily mollusks, within the Tertiary/Quaternary shelly sediments that underlie the majority of the Osceola Plain. In the eastern part of the province, many of these features become elongated parallel to the beach ridge strand plain. Their genesis may be related to the origin of wetlands and swamps in swales, in addition to the dissolution of shell material of the undifferentiated Tertiary/Quaternary

Bombing Range Ridge

Bombing Range Ridge, which is entirely within the Bartow quadrangle, is surrounded by the Osceola Plain (Figure 1). It consists of, and is surrounded by, a large region of undifferentiated Quaternary sediments (Scott et al., 2001). The Tertiary/Quaternary shelly sediments are deep enough under the ridge that they do not appear to have a strong influence on surface landforms. Elevations of the province vary from about 75 feet (22.9 meters) to over 145 feet (44.2 meters) above MSL. Bombing Range Ridge is distinct from the surrounding Osceola Plain due to its higher elevation and linear form, the parallel to many of the Pleistocene beach ridges in the region. Bombing Range Ridge appears to have a littoral origin being parallel to the trend of the paleo-ridges throughout northern and central peninsular Florida. The sediments of Bombing Range Ridge are presently mapped as undifferentiated Quaternary sediments, not Cypresshead Formation as in the Lake Wales Ridge Complex six to eight miles (9.7 to 12.9 kilometers) to the west. This suggests Bombing Range Ridge is the result of Pleistocene coastal processes, post-deposition on the Pleistocene Cypresshead Formation. Further work will be required to determine the origin and age of this feature due to limited core and cuttings control and active military operations in the area. Bombing Range Ridge has weakly developed surface drainage to the east and west. Fluvial processes and the development of drainage on the surrounding Osceola Plain is affected by the location of Bombing Range Ridge. Arbutuck Creek and Morgan Hole Creek separate Bombing Range Ridge from the Lake Wales Ridge Complex. Morgan Hole Creek has its headwaters in a swampy region between the two lobes in the northern portion of Bombing Range Ridge and follows the south-southeast trend of the ridge before turning southwest to join Arbutuck Creek. Arbutuck Creek and Morgan Hole Creek drain south into Lake Hokopua in the northwest portion of the Osceola Plain. A series of karst lakes in the Lake Wales Ridge Complex, including Lake Wehychapka and Lake Arbutuck, occur to the west of Bombing Range Ridge, creating separation between it and the Lake Wales Ridge Complex. These karst lakes have a similar pattern and size to many of the karst lakes found within the Lake Wales Ridge Complex, including the probable karst formation of Lake Hokopua to the south in the Osceola Plain. The karst formation of these lakes appears to be related to dissolution of the shell beds in the Tertiary/Quaternary shelly sediments that underlie the surficial undifferentiated Quaternary sediments.

Lakes District

The Lakes District occupies most of the Central Highlands of Cooke (1939) in peninsular Florida. The district lies east of the Ocala Karst and Peace River districts, west of the Barrier Island and Everglades districts, and south of the Okefenokee Basin District (Figure 3). A thick sequence of up to 200 feet (61 meters) of siliciclastic and carbonate sediments of the Hawthorn Group, siliciclastic sediments of the Cypresshead Formation, and undifferentiated Tertiary/Quaternary sediments overlie the Ocala Limestone in the Lakes District, except from central Polk County and southward, where Suwannee Limestone is present, and where the Ocala Limestone and the Hawthorn Group are locally absent (Arthur et al., 2000). Dissolution of carbonate and subsequent subsidence or collapse has created the characteristic rolling hills, sinkhole lakes, and dry sinks that dominate the landscape. Portions of the district are internally drained due to the presence of karst features and permeable sand cover. Elevations in the Lakes District vary from less than five feet (1.5 meters) above MSL to nearly 315 feet (96 meters) above MSL. In the study area, the only province within Lakes District is the Lake Wales Ridge (Figure 4). Elevations of the district within the Bartow quadrangle range from 45 feet (13.7 meters) to 310 feet (94.5 meters) above MSL. The higher elevation regions were once part of an extensive Cypresshead Formation upland that subsequently eroded, leaving remnant highs. The boundaries of the district generally follow the outcrop belt of the Cypresshead Formation in Florida. Topographic relief between the sandy ridges and the karst lakes can be over 100 feet (30.5 meters) in the hillier regions. Sea-level fluctuations have influenced landform development of the Lakes District, evident by its coast-parallel orientation, and many of its provinces are relict beach ridges associated with deposition of the Cypresshead Formation. In some areas, the distribution of karst lakes is controlled by the beach ridges, with many of the lakes occurring in the flanks or toes of the ridges. Drainage in the district is mostly interior with few surface streams other than those draining to the local karst lakes, or occasionally connecting a chain of lakes. Distinctive circular to sub-circular lakes are visible in aerial photographs, LiDAR, maps, and satellite imagery, revealing the individual sinkholes and coalescing sinkholes which give the Lakes District its name. Dissolution of limestone and subsequent subsidence or collapse of the overlying siliciclastic sediments has formed karst lakes of varying size and depth, and some exist as wetlands or dry depressions. Swallows (stream-to-sea features) are present in the district, but most are small and few are documented. Springs are also common in the Lakes District, but they are much more abundant in the northern portion than in the Bartow quadrangle.

Lake Wales Ridge Complex

The Lake Wales Ridge Complex is a remnant of a once broader upland which has a coastal depositional history (Figure 4). It is underlain by the Cypresshead Formation. This province has been eroded and lowered by sea-level fluctuations, fluvial erosion, aeolian redistribution of sediments, and karst processes. Elevations range from 50 feet (15.2 meters) to more than 310 feet (94.5 meters) above MSL. Within the mapped area, elevations range from 50 feet (15.2 meters) to 300 feet (91.4 meters) above MSL. The area is well drained via the numerous karst features present. Aeolian dune fields are present in many regions. Sediment in these areas often lacks some of the clay that may be present where the Cypresshead Formation is at or near the surface, and water rapidly infiltrates the ground. The most common features of the Lake Wales Ridge Complex are numerous karst lakes. The location of the lakes in the province appear to be strongly related to swale locations. Concentrated linearly and largely following the north-northwest to south-southeast trend of the beach ridges, these swales create a trellis drainage pattern of streams and wetlands. Springs are not common except in the northern part of the province. The upper Peace River valley contains several swallows, some in-channel, and others only capturing water during high flow conditions. Mapped and documented swallow features are not common in the remainder of the Lake Wales Ridge Complex.

Peace River District

The Peace River District covers much of west-central peninsular Florida, extending from Hillsborough and Pinellas counties southward to the Caloosahatchee valley in Lee and Glades counties. The district lies south of the Ocala Karst District, west of the Lakes District, and northwest of the Everglades District (Figure 3). Of the three provinces in the district, only the Hardee Upland is present within the mapped area. Elevations in the district range from sea level to more than 190 feet (57.9 meters) above MSL in the hills near the headwaters of the Alafia River. Within the Bartow quadrangle, elevations in the Peace River District range from 10 feet (3.1 meters) to 190 feet (57.9 meters) above MSL. Low permeability of the siliciclastic sediments of the Hawthorn Group underlie the Peace River District affecting the development of numerous rivers and streams, including the Alafia, Little Manatee, Manatee, Myakka, Peace, and their tributaries (Scott et al., 2001). Drainage in the district is predominantly dendritic. The Peace River District has limited karst development due to the thick cover of Hawthorn Group sediments over most of the region. Karst is limited to sag ponds and swampy areas that develop above shell beds, typically within the undifferentiated Tertiary/Quaternary shelly sediments. Springs occur, but almost all are located near the coastline. Karst features become more common in the north where the Tampa Member of the Arcadia Formation and the Suwannee Limestone approach land surface and the Hawthorn Group clayey sediments thin. Cover-collapse sinkholes are not common in the district. The transition from the Peace River District to the Lakes District occurs where the low permeability sediments of the Hawthorn Group either become more permeable due to facies changes, or where Hawthorn Group sediments are eroded and no longer retard the development of karst features. The landscape of the Peace River District is relatively flat, with limited relief outside of areas incised by local rivers and hills in the eastern part of the district in the Hardee Upland.

Hardee Upland

Sand and clayey sand of weathered Hawthorn Group, reworked Cypresshead Formation sediments, and undifferentiated Quaternary siliciclastic sediments overlie the Hawthorn Group throughout the Hardee Upland (Scott et al., 2001). Hawthorn Group sediments (usually the Peace River Formation) consisting of phosphatic sand, clay, and carbonate, overlie the Suwannee Limestone (Arthur et al., 2000). Carbonates of the Tampa Member of the Arcadia Formation and Suwannee Limestone appear near the surface, and karst becomes more prevalent in the northern part of the province. Much of the northern Hardee Upland has been terraformed due to phosphate mining throughout the 20th and into the 21st century. The Hardee Upland is a broad, south-southeasterly sloped plain (Figure 1). Elevations vary from about 10 feet (3 meters) in the incised river valleys, toward the Gulf of Mexico over 190 feet (57.9 meters) above MSL. Elevations range from 120 feet (36.6 meters) to 155 feet (47.2 meters) above MSL in the portion of the province in the mapped area. The Hardee Upland includes the headwaters and most of the tributaries of the Alafia, Little Manatee, Manatee, and Myakka rivers. Although there are isolated wetland features, most of the region is drained by overland flow, though river corridors can be swampy. Most of the drainage is dendritic, primarily developed on the siliciclastic sediments of the Peace River Formation. The remnant trellis drainage in the upper Peace River may have been inherited from the ridges and swales of the western Lake Wales Ridge Complex to the north, but the ridges and swales are no longer evident in the northeastern Hardee Upland. Due to the thick cover of Hawthorn Group sediments over much of the province, very few karst features are present on the Hardee Upland. Springs are present mostly in the southwestern province in the Alafia River valley and the northern portion of the province, the overlying clayey sediments of the Hawthorn Group thin, and limestones of the Arcadia Formation and the Suwannee Limestone are near the surface. Cover collapse sinkholes occur in this portion of the Hardee Upland.

*Note: See Open-File Report 108 for references

Disclaimer

This map was created using Florida Department of Environmental Protection (DEP) databases and data obtained from the Florida Geological Survey (FGS). It was completed August 31, 2019, by the DEP/FGS Geological Investigations Section. This document was prepared for the presentation of the geologic information shown and is not intended to replace site-specific or use-specific investigations. The FGS does not guarantee this document to be free from errors or inaccuracies and disclaims any responsibility or liability for inappropriate change of scale, interpretation, or decisions based thereon. Cooperatively funded by the DEP/FGS and the U.S. Geological Survey (USGS), National Cooperative Geologic Mapping Program, under USGS assistance award number G18AC00295. The views and conclusions in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Figure 1. Geomorphic provinces (modified from Williams et al., in preparation) with LiDAR-based digital elevation model (DEM) mosaic.

Figure 2. Springs and subsidence incident reports (SIRs) shown with LiDAR-based digital elevation model (DEM) mosaic.

Figure 3. Geomorphic districts (modified from Williams et al., in preparation).

Figure 4. Geomorphic provinces (modified from Williams et al., in preparation).

Legend for Figures 1 & 2

- City/town
- County boundary
- Primary highway
- Secondary highway
- USGS 1:24,000 Quadrangle tick mark
- Geomorphic province boundary
- Geomorphic district boundary
- State lands and parks
- River or stream
- Wetland
- Karst Features
 - Sinkhole
 - Spring
 - Subsidence incident report (SIR)

NOTE: Information regarding subsidence incident reports maintained by the FGS can be found at <https://floridageo.com/geospatial/subsidence-incident-reports>

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<https://floridageo.com/geospatial/contacts/talesmap>

APPROXIMATE MEAN DECLINATION, 2019

1:24,000 Quadrangle Grid

WILDERNESS	BARTOW	ELZON	LAKE WEAVER	HESPERIDES	LAKE ARBuckle	LAKE MARION	LAKE WEAVER NE
BRIDLE FINDER	HOWLAND	AUTUMN	BURNING PARK	LAKE ARBuckle	LAKE ARBuckle	LAKE MARION	LAKE WEAVER NE
BAIRD	BOWLING GREEN	BEREA	FOOTBRIDGE	LAKE ARBuckle	LAKE ARBuckle	LAKE MARION	LAKE WEAVER NE
FORT GREEN	WALCHILLA	GRIPPING CARBIDE	AVON PARK	LAKE ARBuckle	LAKE ARBuckle	LAKE MARION	LAKE WEAVER NE

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