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Herschel T. Vinyard Jr.
Secretary

OPEN-FILE MAP SERIES 104, Plate 3

GEOMORPHOLOGY, SPRINGS, AND KARST FEATURES OF THE USGS TARPON SPRINGS 30 X 60 MINUTE QUADRANGLE, CENTRAL FLORIDA

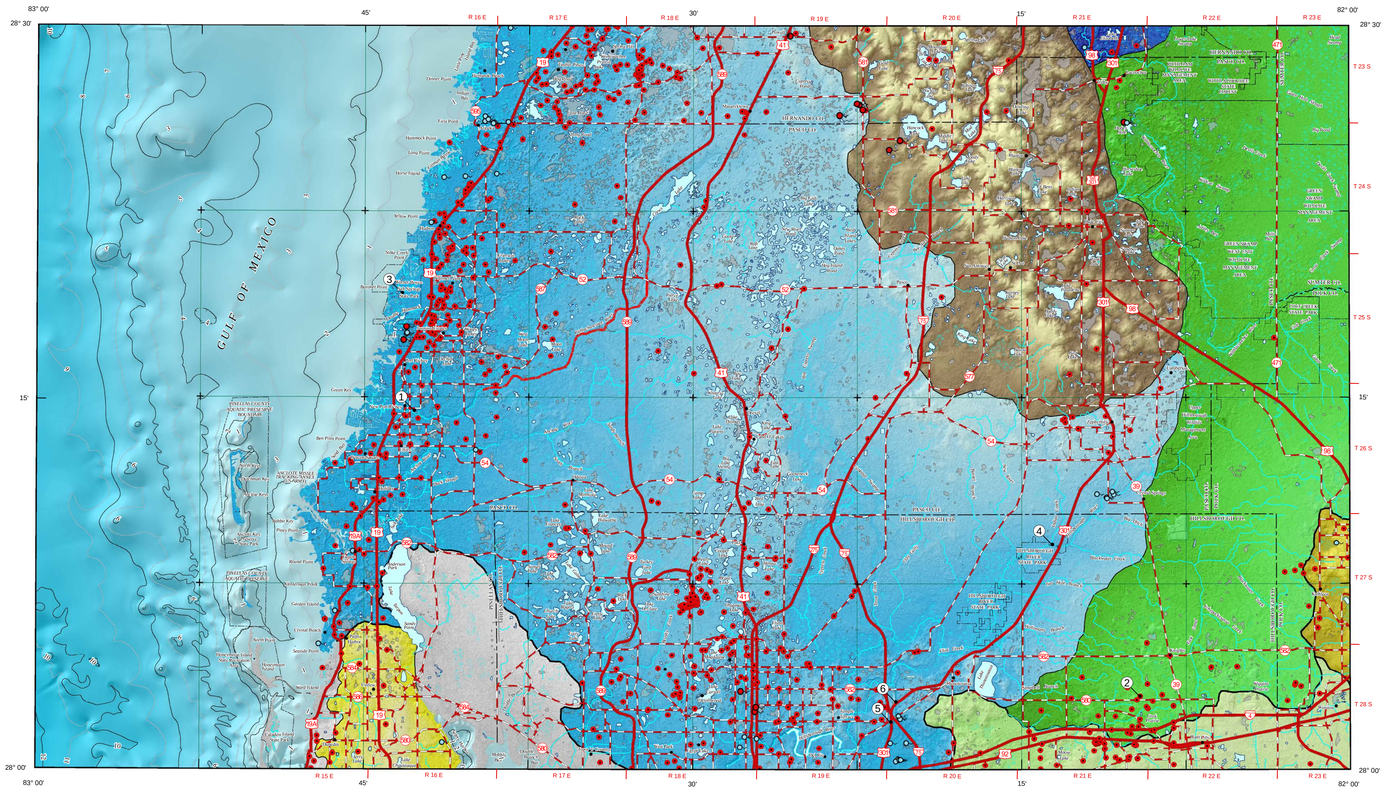
2012

BY

RICHARD C. GREEN (P.G. #1776), WILLIAM L. EVANS, III, P.G., CHRISTOPHER P. WILLIAMS, P.G., CLINTON KROMHOUT, P.G., SETH W. BASSETT, AND LEVI HANNON

Jonathan D. Arthur
State Geologist and Director

Figure 1. Geomorphic terranes (modified from Scott et al., in preparation), springs, and karst features shown with LiDAR-based digital elevation model (DEM).



0 5 10 15 20 MI
0 5 10 15 20 25 30 KM

Scale = 1:180,000

BATHYMETRIC INTERVAL 1 METER

Elevations shown to the nearest meter

Projection: FDEP Albers HARN North American Datum 1983 (NAD83)

N W E S

Central Lakes District

The Central Lakes District occupies most of the Central Highlands of Cooke (1939) in peninsular Florida. The district extends from eastern Alachua County, southeastern Bradford County and southern Clay County to southernmost Highlands County (Figure 2). The Central Lakes District lies east and south of the Ocala Karst District, south of the Okefenokee Basin District, west of the Barrier Island Sequence District, east of the Sarasota River District, and north of the Everglades District. A thick (up to 200 feet [61 meters]) sequence of siliciclastic and carbonate sediments of the Hawthorn Group and siliciclastic sediments of the Cypresshead Formation and undifferentiated sediments overlie the Ocala Limestone in the district. Dissolution of the limestone 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 karst features and the permeable sand cover. Elevations vary from approximately 50 feet (15.2 meters) above mean sea level (MSL) to more than 300 feet (91.4 meters) above MSL.

Lake Wales Ridge Complex

Elevation Range (MSL)
230 FT (70.1 M)
110 FT (33.5 M)

The Lake Wales Ridge Complex is an area of higher elevation rising above the Green Swamp to the north and west and the Polk-DeSoto Plain to the south and southwest (Figures 1 and 3). The ridge area is the remnant of a broader upland that has been eroded and lowered by sea level fluctuations, fluvial erosion and aeolian redistribution of sediments. Elevations generally range from 20 feet (6.1 meters) to 310 feet (94.5 meters) above MSL. The Lake Wales Ridge Complex is only found along the eastern edge of the study area where elevations range from 110 feet (33.5 meters) to 230 feet (70.1 meters) above MSL. The complex is predominantly well drained. Drainage is primarily internal through the numerous karst features present. The Lower Oligocene Suwannee Limestone underlies the Lake Wales Ridge Complex within the study area (Arthur et al., 2008). The Oligocene-Pliocene Hawthorn Group, consisting of phosphatic sand, clay and carbonate, overlies the Suwannee Limestone. Sand and clayey sand of the Pliocene-Pleistocene Cypresshead Formation overlie the Hawthorn Group (Scott et al., 2001). In some areas, aeolian sand dunes are present.

Ocala Karst District

The Ocala Karst District encompasses a broad area from central Wakulla County in the panhandle of Florida, south to Hillsborough and Pinellas Counties in the west-central peninsula and inland to nearly the center of the peninsula (Figure 2). Elevations within the district and the study area range from sea level along the Gulf of Mexico coast in excess of 300 feet (91.4 meters) above MSL on the Brooksville Ridge. Carbonate sediments of the Upper Eocene Ocala Limestone and Lower Oligocene Suwannee Limestone lie at or near the land surface in this district within the study area. There also exist Miocene undifferentiated Hawthorn Group, undifferentiated Tertiary/Quaternary sediments, and Quaternary Beach Ridge and Dune sediments, the latter particularly associated with or along the western flank of the Brooksville Ridge. The Ocala Karst District is dominated by sinkholes and shallow bowl-shaped depressions, producing a rolling topography. Generally, a variably permeable siliciclastic cover allows downward percolating groundwater to slowly dissolve the underlying limestone, leading to cover-collapse sinkholes and cover-subsidence features (Sinclair and Stewart, 1985). Cover-collapse sinkholes form rather abruptly from the structural failure of an underlying cavern roof. An excellent example of this is at Devil's Millhopper Geological State Park, located in Alachua County north of the present study area (Evans et al., 2004). Cover subsidence features generally occur in areas where sediments sag as carbonates dissolve underneath. Typically, areas such as these have shallow sinks formed by the downward raveling of the siliciclastic overburden filling voids created by slow dissolution of underlying carbonates or by slow dissolution of the carbonate surface. Springs, sinks, sinking (swallets) and resurgent streams, and caverns commonly occur within the Ocala Karst District.

Brooksville Ridge

Elevation Range (MSL)
300 FT (91.4 M)
65 FT (19.8 M)

The Brooksville Ridge, described by White (1970) as "the most massive of the ridges which rise above the general level of the Central Upland", stands out in stark contrast to the surrounding karst plains. The Brooksville Ridge is divided by the Withlacoochee River, which separates the ridge into northern and southern sections (Figures 1 and 3). The topography of the Brooksville Ridge displays significant variability ranging in elevations from nearly sea level to over 300 feet (91.4 meters) above MSL. Within the study area, elevations range from 65 feet (19.8 meters) to 300 feet (91.4 meters) above MSL. The northern ridge section has low, rolling karst hills interspersed with moderately shallow sinkholes. The southern portion of the ridge becomes progressively more hilly and the terrain relief increases from north to south with sand dunes common on the western flank of the ridge. From the vicinity of Brooksville southward, the hills are higher and more closely spaced. North of Brooksville, the hills are more widely spaced and generally lower elevations, an indication of more mature karst. The northern portion of the ridge is composed of Undifferentiated Tertiary and Quaternary sediments likely derived from the Hawthorn Group and is underlain by the Upper Eocene Ocala Limestone. The southern Brooksville Ridge is more complex geologically than the northern section and is underlain by Lower Oligocene Suwannee Limestone or Upper Eocene Ocala Limestone with variable thicknesses of weathered Miocene Hawthorn Group sediments, Quaternary and Tertiary/Quaternary siliciclastics, and relict dunes (Quaternary Beach Ridge and Dune).

Green Swamp

Elevation Range (MSL)
150 FT (45.7 M)
40 FT (12.2 M)

The Green Swamp occurs in parts of Hernando, Pasco, Sumter, Lake, Polk and Hillsborough Counties (Figures 1 and 3). It is bounded on the north by the Williston Karst Plain, on the west by the Brooksville Ridge and Land O' Lakes Karst Plain, on the south by the Polk-DeSoto Plain and on the south and east by the Lake Wales Ridge Complex. Elevations within the swamp range from 40 feet (12.2 meters above sea level) to 200 feet (61 meters) above MSL. The entire area is very poorly drained and swamp conditions prevail due to the high potentiometric surface of the Floridan aquifer system. Few areas of sand dunes are found in the swamp. Karst features are common throughout the Green Swamp but there are few springs. The Green Swamp occurs in the eastern part of the study area where elevations range from 40 feet (12.2 meters) to 150 feet (45.7 meters) above MSL. The Green Swamp is primarily underlain by the Upper Eocene Ocala Limestone with the Lower Oligocene Suwannee Limestone under the southwestern part of the area. Hawthorn Group sediments occur scattered throughout the swamp. Undifferentiated Tertiary/Quaternary siliciclastic sediments cover much of the Green Swamp. Within the study area, Green Swamp is underlain by either Ocala Limestone or Suwannee Limestone and Quaternary undifferentiated sediments.

Land O' Lakes Karst Plain

Elevation Range (MSL)
140 FT (42.7 M)
0 FT (0 M)

The Land O' Lakes Karst Plain occurs from southwestern Hernando County southward to Pinellas and Hillsborough Counties. It lies west of the southern end of the Brooksville Ridge, west of the Green Swamp and north and west of the Polk-DeSoto Plain, Coastal Lowlands and Pinellas Ridge (Figures 1 and 3). Elevations of the karst plain within the study area range from sea level to more than 140 feet (42.7 meters) above MSL. The occurrence of karst features varies from abundant and closely spaced to scattered. Sand dunes are present in several areas of the karst plain. This area varies from poorly drained to well drained and there are many springs. The northern half of the Land O' Lakes Karst Plain is underlain by the Lower Oligocene Suwannee Limestone or the Upper Eocene Ocala Limestone where the Suwannee Limestone is missing due to erosion. The Upper Oligocene to Lower Miocene Tampa Member of the Arcadia Formation, Hawthorn Group underlies the southern portion of the karst plain. Clays and sands of the undifferentiated Hawthorn Group overlie the carbonate sediments over some of the area. An overburden of undifferentiated Quaternary siliciclastic sediments and quaternary Beach Ridge and Dune covers much of the karst plain.

Williston Karst Plain

Elevation Range (MSL)
110 FT (33.5 M)
50 FT (15.2 M)

The Williston Karst Plain occurs from northwestern Gilchrist County southward through Alachua, Levy, Marion, Citrus, Sumter, and Hernando Counties (Figures 1 and 3). Elevations range from 10 feet (3.0 meters) to 165 feet (50.3 meters) above MSL. Within the mapped area, elevations of the terrane range from 50 feet (15.2 meters) to 110 feet (33.5 meters) above MSL. The Williston Karst Plain, located on the eastern flank of the Brooksville Ridge, extends eastward to the Hawthorne Lakes Region, the Fairfield Karst Hills, the Ocala Karst Hills, the Tavares Lakes Region, and the Lake Wales Ridge Complex and is underlain by the Upper Eocene Ocala Limestone. Much of the Williston Karst Plain is well drained. However, the southern portion becomes more poorly drained toward Tsala Apopka Lake and the Green Swamp. A number of springs occur within the karst plain. Within the study area, the Williston Karst Plain is underlain by the Upper Eocene Ocala Limestone. Undifferentiated Tertiary/Quaternary siliciclastic sediment covers the karst plain and small dune fields are common in the area.

Sarasota River District

The Sarasota River District covers much of west-central peninsular Florida extending from Hillsborough and Pinellas Counties southward to the Caloosahatchee River in Lee and Glades Counties. The Sarasota River District lies south of the Ocala Karst District, west of the Central Lakes District and north of the Everglades District (Figure 2). Impermeable siliciclastic sediments of the Upper Oligocene-Lower Pliocene Hawthorn Group underlie the Sarasota River District allowing the development of the numerous rivers and streams. The district is characterized by this occurrence of numerous rivers and streams which are more common than in any other geomorphic district in Florida. The rivers in the Sarasota River District include the Alafia, Peace, Manatee, Braden, and Myakka Rivers and their tributaries. The Ocala Karst District merges with the Sarasota River District where the Hawthorn Group sediments retard the development of karst features. The Sarasota River District to Central Lakes District transition occurs where the impermeable sediments of the Hawthorn Group either become more permeable due to a facies change or where the Hawthorn Group sediments are eroded and no longer retard the development of karst features. The separation of the Sarasota River District from the Everglades District occurs where the surface-water flow pattern shifts to a southerly, broad flow pattern. The landscape of the Sarasota River District is relatively flat with limited relief. Elevations range from sea level along the Gulf of Mexico to more than 185 feet (56.4 meters) above MSL along the boundary with the Central Lakes District. The Sarasota River District includes the Coastal Lowlands, Pinellas Ridge and the Polk-DeSoto Plain. The Polk-DeSoto Plain occurs in a limited area along the southeastern edge of the study area.

Coastal Lowlands

Elevation Range (MSL)
50 FT (15.2 M)
0 FT (0 M)

The Coastal Lowlands terrane forms the western portion of the Sarasota River District adjacent to the Gulf of Mexico. It nearly surrounds the Pinellas Ridge in Pinellas County. It occurs in the region west and south of the Polk-DeSoto Plain (Figures 1 and 3). Elevations in the Coastal Lowlands vary from sea level to 77 feet (23.5 meters) above MSL. The coastal areas have had greater impacts of erosion from more recent Pleistocene sea levels than the relative highland areas to the east in the Polk-DeSoto Plain. The greatest variability in elevations in the Coastal Lowlands is in the river valleys that drain to the west and south in the Sarasota River District. Most of the terrane is underlain by Upper Oligocene-Lower Pliocene Hawthorn Group units and Pliocene-Pleistocene shelly sediments. Within the study area, elevations in the Coastal Lowlands range from sea level to 50 feet (15.2 meters) above MSL. Changes in elevation are not extreme due to the location of this terrane in the study area being limited to the northern end of Old Tampa Bay and the coastal areas west of the Pinellas Ridge. The geologic units underlying the terrane in this area are the Upper Oligocene-Lower Miocene Tampa Member, Arcadia Formation, Hawthorn Group and undifferentiated Quaternary sediments as well as Holocene sands of the barrier islands on the Gulf of Mexico coastline.

Pinellas Ridge

Elevation Range (MSL)
105 FT (32.0 M)
0 FT (0 M)

The Pinellas Ridge occurs on the northern Pinellas peninsula in Pinellas County. It is bounded on the north by the Land O' Lakes Karst Plain and on the west, south and east by the Coastal Lowlands which broaden toward the south and east (Figures 1 and 3). The Pinellas Ridge consists of Miocene undifferentiated Hawthorn Group and undifferentiated Quaternary sediments that remain as a relative highland in Pinellas County. The northern portion of the ridge occurs within the map area. Elevations within the terrane and the study area range from sea level to 105 feet (32 meters) above MSL. The ridge is well drained. The portion of the Pinellas Ridge occurring in the map area is karstic. There are numerous sinkholes apparent on topographic maps, LiDAR and aerial photographs.

Polk-DeSoto Plain

Elevation Range (MSL)
170 FT (51.8 M)
30 FT (9.1 M)

The Polk-DeSoto Plain occurs west of the Lake Wales Ridge Complex, south of the Green Swamp, southeast of the Land O' Lakes Karst Plain, and east of the Coastal Lowlands (Figures 1 and 3). Elevations range from 5 feet (1.5 meters) to 185 feet (56.4 meters) above MSL. The terrain is relatively flat with the greatest relief occurring along numerous stream and river valleys that are incised into the underlying Upper Oligocene-Lower Pliocene Hawthorn Group and undifferentiated Quaternary siliciclastic sediments. Very few karst features are recognized on the Polk-DeSoto Plain. The Polk-DeSoto Plain only occurs in the southeasternmost portion of the study area where the elevation ranges from 30 feet (9.1 meters) to 170 feet (51.8 meters) above MSL. The Lower Oligocene Suwannee Limestone underlies the Polk-DeSoto Plain within the study area. The Hawthorn Group, consisting of phosphatic sand, clay and carbonate, overlies the Suwannee Limestone. Sand and clayey sand of the weathered Hawthorn Group and undifferentiated Quaternary siliciclastic sediments overlie the Hawthorn Group (Scott et al., 2001).

Legend for Figure 1

- City
- County boundary
- US highway
- State road
- River, stream, or canal
- Lake or pond
- 7.5 Minute quadrangle
- State park or reserve
- Wetland
- Closed Topographic Depressions (CTDs)
- Bathymetry: 1 Meter Interval, Index, Intermediate
- Geomorphic district boundary
- Photo location callout

Karst Features

- Spring
- Swallet
- Sinkhole or other karst feature

Figure 2. Geomorphic districts (modified from Scott et al., in preparation)

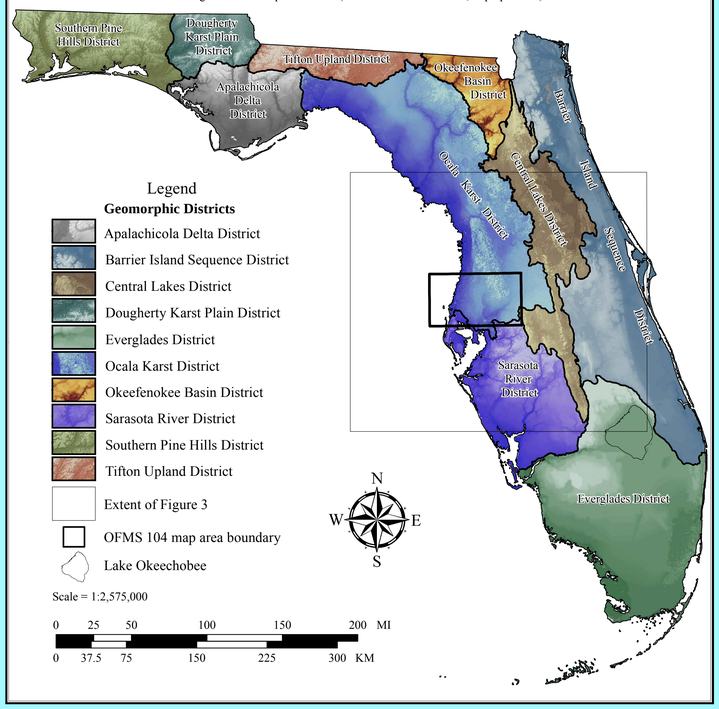
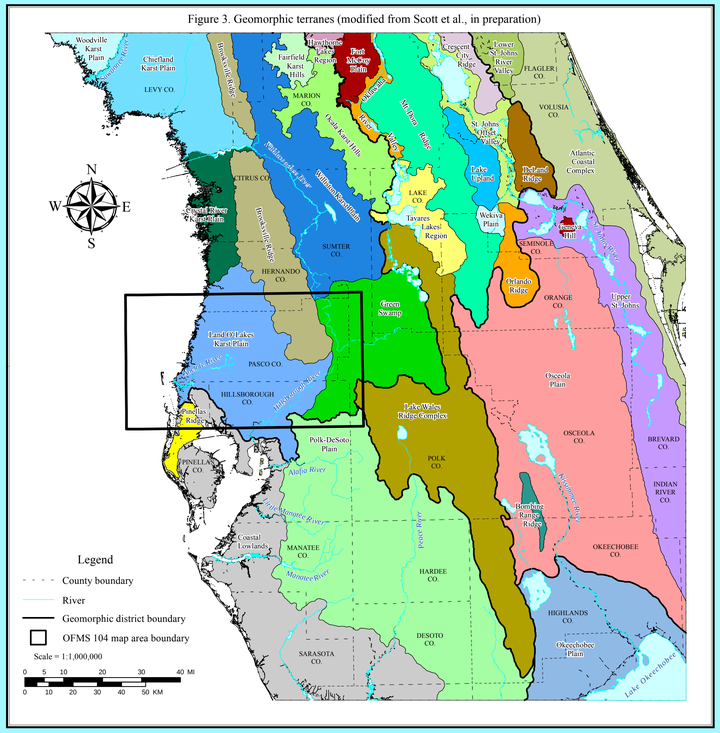
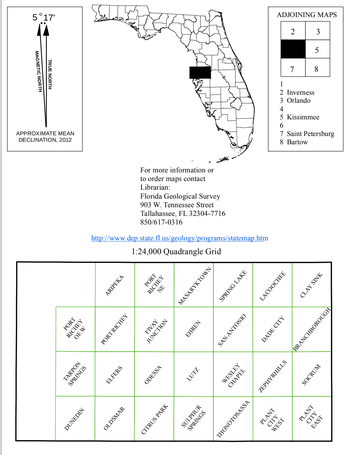


Figure 3. Geomorphic terranes (modified from Scott et al., in preparation)





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Tallahassee, FL 32304-7716
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http://www.dep.state.fl.us/geology/programs/statemap.htm

1:24,000 Quadrangle Grid

This map was created using Florida Department of Environmental Protection (FDEP) databases and data obtained from the Florida Geological Survey (FGS). It was completed August 31, 2012, by the FDEP 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, interpretations, or decisions based thereon. Cooperatively funded by the FGS and the U.S. Geological Survey (USGS), National Cooperative Geologic Mapping Program, under USGS assistance award number G11AC20418. 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.

SELECTED PHOTOGRAPHS

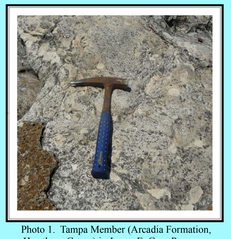

Photo 1. Tampa Member (Arcadia Formation, Hawthorn Group) in James E. Grey Preserve along northern side of Pithlachascotee River.
Location: T 26 S, R 16 E, S 9, SW 1/4 of NW 1/4
Photo by Rick Green
Date taken: 5/23/2012

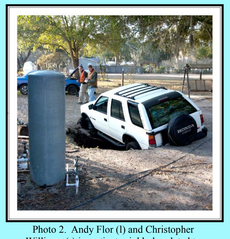

Photo 2. Andy Flor (l) and Christopher Williams (r) investigate sinkhole related to January 2010 frost-freeze event.
Location: T 28 S, R 21 E, S 13, SW 1/4 of NE 1/4
Photo by Rick Green
Date taken: 1/14/2010

Photo 3. Clint Kromhout examines chert outcrop in Werner-Boyce Salt Springs State Park.
Location: T 25 S, R 16 E, S 8, SW 1/4 of SE 1/4
Photo by Rick Green
Date taken: 5/21/2012

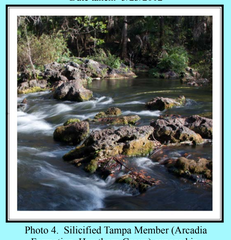

Photo 4. Silicified Tampa Member (Arcadia Formation, Hawthorn Group) exposed in Hillsborough River State Park.
Location: T 27 S, R 21 E, S 8, SW 1/4 of NE 1/4
Photo by Rick Green
Date taken: 2/16/2012

Photo 5. Sam Upchurch (l), Tom Scott (m), and Rick Green (b) examine Hawthorn Group sediments in outcrop along west side of US 301.
Location: T 28 S, R 20 E, S 19, NW 1/4 of SW 1/4
Photo by Clint Kromhout
Date taken: 4/17/2012

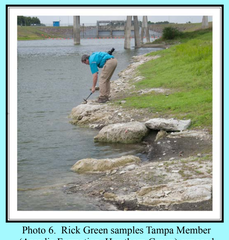

Photo 6. Rick Green samples Tampa Member (Arcadia Formation, Hawthorn Group) exposed along Tampa Bypass Canal.
Location: T 28 S, R 20 E, S 18, NE 1/4 of SW 1/4
Photo by Clint Kromhout
Date taken: 4/19/2012

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