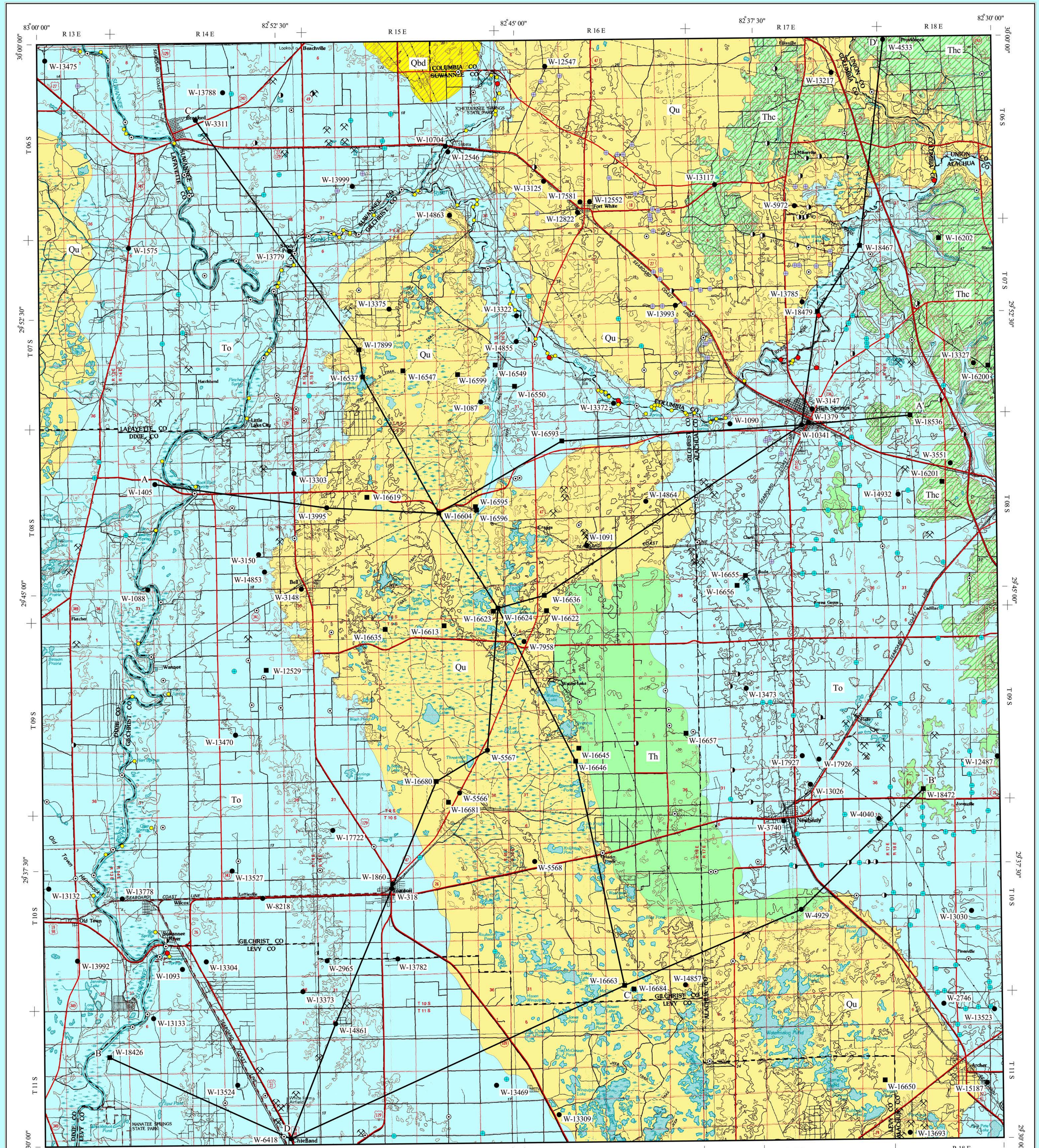


OPEN FILE MAP SERIES NO. 93-01

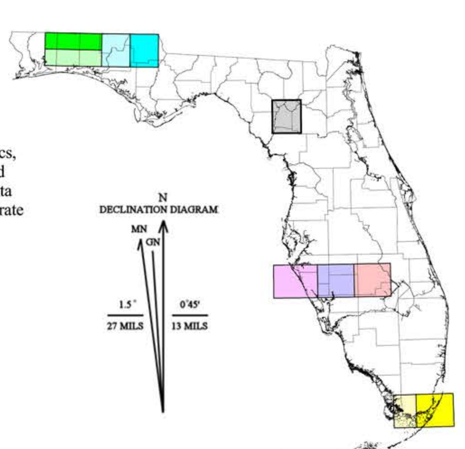
GEOLOGIC MAP OF THE WESTERN PORTION OF THE U.S.G.S. 1:100,000 SCALE GAINESVILLE QUADRANGLE, NORTHERN FLORIDA

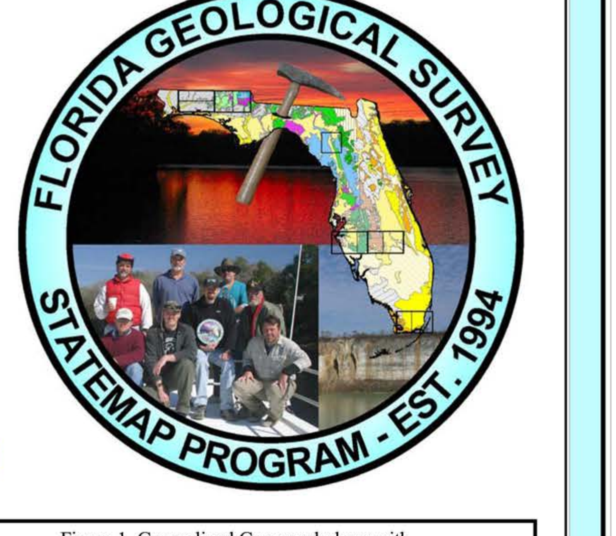
2004

BY

WILLIAM L. EVANS III, P.G. #1821, RICHARD C. GREEN, P.G., JONATHAN R. BRYAN, AND DAVID T. PAUL

LEGEND FOR GEOLOGIC MAP





Quaternary – Pleistocene/Holocene

Qbd – **Quaternary Beach Ridge and Dune**

Sediments exhibiting discernable beach ridges and dunes have been mapped separately from undifferentiated Quaternary Sediments. These sediments consist of light gray to tan, fine to medium quartz sand with a variable percentage of organic material.

Qu – **Undifferentiated Quaternary Sediments**

Light brown to tan, medium-fine quartz sand with variable admixtures of clay and organics, unconsolidated to poorly indurated. This unit may contain significant amounts of clay and organics. Local beds of fresh-water marl, which only occur in the flood plains of the Santa Fe River and Ichetucknee River, are limited in aerial extent and are not mapped as a separate unit on the geologic map.

Tertiary – Miocene

Hawthorn Group

Th – **Undifferentiated Hawthorn Group**

The undifferentiated Hawthorn Group sediments occur at or near the surface in eastern Gilchrist County and western Alachua County and are associated with the Brooksville Ridge (Figure 1). These sediments are typically weathered blue gray to reddish-brown clayey sands to silty clays and pure clays with relatively little phosphate.

Thc – **Coosawhatchie Formation**

The Coosawhatchie Formation consists of gray to bluish-gray sandy clay or clayey sand with phosphate grains, and calcitic to dolomitic carbonates. Lenses of relatively pure quartz sands, clays or limestone are not uncommon. This unit is lithologically variable and units may pinch out and interfinger both laterally and vertically. Outcrops of Coosawhatchie Formation in the study area are typically very weathered and the lithology consists of reddish-brown to white, clayey, calcareous quartz sands to sandy clays with leached phosphate grains and limonitic and calcareous pebbles.

Tertiary – Oligocene

Ts ⊕ – **Suwannee Limestone (Residuum)**

Although only found as silicified "float" in the study area, the Suwannee Limestone appears to be continuous in the subsurface north and east of the study area in northwestern Alachua County and western Union County (Clark et al., 1964). The Suwannee Limestone usually consists of a cream to tan, crystalline, poorly to well indurated, vuggy and muddy carbonate (grainstone to packstone) containing gastropods, echinoids, and pelycypods, as well as abundant benthic foraminifera. This lithology is variably dolomitic, and the dolostone may be interbedded with limestone beds. Layers of chert may be present.

Tertiary – Eocene

To – **Ocala Limestone**

White to creamed-colored, fine to coarse grained, poorly to well indurated, poorly sorted, fossiliferous limestone (wackestone, packstone, and grainstone). Lower Ocala may be dolomitized, and may also include layers of chert. Fossils include foraminifera, *Lepidocyclina* sp., *Heterostegina ocalana and Asterocyclina* spp., milliolids, bryozoans, mollusks, echinoids, crabs, and algae.

Tap – **Avon Park Formation (present in subsurface only)**

Cream to light-brown to tan, very fine to medium grained, poorly indurated to well indurated, variably fossiliferous limestone (wackestone, packstone, and grainstone) interbedded with tan to brown, very poorly indurated to well indurated, very fine to medium crystalline, (fossil) moldic and vuggy dolostone. Fossils include foraminifers, algae, echinoids, and carbonized plant remains.

Interstate; Primary / Secondary road; Local road; Railroad; County Boundary; Power Transmission Line; State Park or Recreation Area; River or Stream; Lake or Pond; Wetland; U.S. Public Lands Survey; Quarry or Pit; Outcrop; First Magnitude Spring; Second, Third or Fourth Magnitude Spring; Contours: 5 Meter Interval – Index, Intermediate; Core; Cuttings; Ocala Limestone Float; Suwannee Limestone Float; Archived M-Series Sample; Cross-section Line

1 0 1 2 3 4 5 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometers

FLORIDA GEOLOGICAL SURVEY OPEN-FILE MAP SERIES (O.F.M.S.) PRODUCED UNDER THE STATEMAP PROGRAM

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Figure 1. Generalized Geomorphology with 1:24,000 Scale Quadrangles.

Alachua Karst Hills; Chiefland Karst Plain; Brooksville Ridge; Bell Ridge; Branford Karst Plain; Waccasassa Flats; Perry Karst-San Pedro Bay; Williston Karst Plain

10 0 10 Kilometers

5 0 5 10 15 Miles

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

Basemap: Georeferenced TIF of U.S.G.S. 1:100,000-scale metric topographic map of Gainesville, Florida

Geologic Discussion

The near surface geology of the western portion of the U.S.G.S. 1:100,000 scale Gainesville quadrangle is composed of a complex mixture of carbonate and siliciclastic sediments ranging from Eocene to Holocene. A combination of factors, including fluvio-deltaic deposition, marine deposition, dissolution of underlying carbonates, erosion of sediments as a result of eustatic changes in sea level, and structural features, have influenced the geology of the study area.

Much of the western portion of the Gainesville quadrangle is located within the Suwannee River and Santa Fe River basins. In this area, the Suwannee River, the Santa Fe River, and their tributaries contain at least 55 documented springs, including 9 first magnitude springs (defined as having a minimum average flow of 100 cubic feet per second, or 64.6 million gallons per day). Of a total of 33 first magnitude springs in the state, approximately 27 percent are located within the study area. Many of these springs have evidenced significant increases in pollutants in the last few decades, particularly nitrate (Scott, et al., 2002). Detailed geologic mapping of lithostratigraphic units in this area provides critical data needed to help in future assessments of the vulnerability of these aquifer systems to contamination.

Several structural, sedimentological and geomorphic variables have affected the geology of the region. The Peninsular Arch, a structurally high area which affected deposition from the early Cenozoic through the Oligocene (Williams et al., 1977; Miller, 1986; Randazzo and Jones, ed., 1997), is the dominant subsurface feature in the Florida peninsula (Applin, 1951). The axis of the Peninsular Arch extends from southeastern Georgia to the vicinity of Lake Okeechobee in south Florida in a general northeast to south-central trend. The crest of the arch passes beneath Alachua County east of the study area and is highest just north of Alachua County in Union and Baker Counties. The arch was a topographic high during most of the Cretaceous Period and had Upper Cretaceous sediments deposited over it (Applin, 1951). It formed a relatively stable base for Eocene carbonate deposition except during times of periodic land emergence due to lowered sea levels (Williams et al., 1977). The arch did not affect Neogene to Holocene sediment deposition (Williams et al., 1977).

The Ocala Platform is the most prominent structure affecting the near surface depositional and post-depositional environments within the study area. Hopkins (1920) originally named this feature the Ocala Uplift. Vernon (1951) described the Ocala Uplift as a gentle flexure developed in Tertiary sediments with a northwest-southeast trending crest. Because there is continuing uncertainty about the origin of this feature, Scott (1988) used the term Ocala Platform, rather than Ocala Uplift or Ocala Arch, since it does not have a structural connotation.

The Ocala Platform exerted its influence on Neogene sediment deposition, and Miocene sediments of the Hawthorn group are thought to have been deposited across the platform (Scott, 1988). Post-Miocene erosion, however, has removed sediments of the Hawthorn Group from much of the crest of the Ocala Platform, exposing Eocene carbonates (Cooke 1945; Pirkle 1956b; Espenshade and Spencer 1963; Brooks, 1966; and Scott, 1981). Undifferentiated sediments have subsequently been deposited on the exposed Eocene carbonates. These consist of residual clays, sands, and eolian sands deposited during the Pliocene to Holocene (Randazzo and Jones, ed., 1997).

Vernon (1951), utilizing aerial photographs, first mapped fracture patterns throughout northern peninsular Florida. Regionally, these fractures generally trend parallel to the axis of the Ocala Platform in a northwest-southeast orientation. A secondary system of fractures intersects these primary fractures at large angles in a northeast-southwest trend (Vernon, 1951). Orientation of stream meanders along the Suwannee and Santa Fe Rivers demonstrates that these fracture patterns may be a controlling factor in stream location. Lakes, sinkholes and other karst features also appear to be forming along these fracture trends.

Several relict Neogene coastal terraces, which developed as a result of fluctuating sea levels, have been documented in the study area. Healy (1975) recognized two marine terraces within the study area: the Wicomico terrace at elevations of 70 to 100 feet (23.0 to 32.8 meters) above mean sea level (MSL) and the Sunderland/Okefenokee terrace at elevations between 100 and 170 feet (32.8 and 55.8 meters) above MSL. The elevations between 150 and 170 feet (49.2 and 55.8 meters) above MSL were referred to as the Okefenokee Terrace by MacNeil (1950) and Alt and Brooks (1965). Detailed discussions and correlations of these marine terraces and relict shorelines have been attempted by many authors, including Matson and Sanford (1913), Cooke (1931, 1939), Flint (1940, 1971), MacNeil (1950), Alt and Brooks (1965), Pirkle et al. (1970), and Healy (1975).

According to Scott (in preparation), the study area falls within one geomorphic province - the Ocala Karst District. This province encompasses a broad area from Wakulla County in the panhandle, south to Hillsborough and Pinellas Counties in the west-central peninsula of Florida. Carbonate sediments ranging from the Middle Eocene Avon Park Formation to the Oligocene Suwannee Limestone lie at or near the land surface within this province.

The Ocala Karst District is dominated by dissolution sinkholes and shallow, bowl-shaped depressions, producing a rolling topography. Generally, these areas have a thin permeable siliciclastic cover where downward percolating groundwater slowly dissolves the underlying limestone, leading to cover-collapse sinkholes and cover-subsidence features. Cover-collapse sinkholes form rather abruptly from the structural failure of an underlying cavern roof. An excellent example of this is Devil's Millhopper, located in Alachua County just east of the present study area.

Cover subsidence features generally occur in areas where the overlying siliciclastics are thicker and the sediments sag as the carbonates dissolve underneath. Typically, areas such as these have only a few shallow sinks formed by the downward movement of the siliciclastic overburden filling voids created by the slow dissolution of the underlying carbonates. Springs, sinking and resurgent streams, and numerous caverns commonly occur within the Ocala Karst District.

The study area has been subdivided topographically into six regional physiographic units (Figure 1): the Branford Karst Plain, Perry Karst - San Pedro Bay, Chiefland Karst Plain, Brooksville Ridge, Williston Karst Plain and Alachua Karst Hills, (White, 1970; Scott, in preparation). One of these regional physiographic units, the Chiefland Karst Plain, has been further subdivided into the Waccasassa Flats (Vernon, 1951) and Bell Ridge (Puri and Vernon, 1964).

The Branford Karst Plain, located in the northern portion of the study area (Figure 1), extends south to the Santa Fe River on the Gilchrist County line (Scott, in preparation). The elevations range from more than 100 feet (30.5 meters) to less than 25 feet (7.6 meters) above MSL along the Santa Fe and Suwannee Rivers. The Upper Eocene Ocala Limestone is near the surface in this area and silicified float boulders of remnant Suwannee Limestone commonly occur throughout the area.

The Perry Karst - San Pedro Bay is in the northwest portion of the study area, just west of Branford, in Lafayette and Dixie Counties (Scott, in preparation). This is a poorly drained area with elevations that generally range from less than 50 feet (15.2 meters), along the western edge of the study area, to 25 feet (7.6 meters) above MSL, west of the study area.

The Chiefland Karst Plain, which lies to the west of the Brooksville Ridge and south of the Branford Karst Plain and Santa Fe River (Figure 1), has elevations ranging from below 25 feet (7.6 meters) to over 100 feet (30.5 meters) above MSL. This karst plain is internally drained, except in the Waccasassa Flats, where less permeable siliciclastic sediments result in numerous wetland areas. Many springs are present within this karst plain, mainly along the Suwannee and Santa Fe Rivers. The entire karst plain is underlain by Upper Eocene Ocala Limestone.

The Chiefland Karst Plain was subdivided by Puri and Vernon (1964) into the Waccasassa Flats and Bell Ridge. The Waccasassa Flats subzone is located in the central portion of Gilchrist County, extending northwards to just south of the Santa Fe River (Figure 1). The generally flat to gently rolling terrain in this region was inundated by transgressive Plio-Pleistocene seas (Col et. al., 1997). This poorly drained area consists of Quaternary sand hills underlain by Plio-Pleistocene siliciclastics and the Ocala Limestone. Rupert (1988) described the Waccasassa Flats in Gilchrist County as being an average of 60 feet (18.3 meters) in elevation, but including isolated hills between 90 and 100 feet (27.4 and 30.5 meters).

The Bell Ridge, which is located along the western flanks of Waccasassa Flats and the eastern edge of the Chiefland Karst Plain, consists of a 20-mile long series of irregularly-shaped ridges. The crests of these ridges, which are most likely a part of the Wicomico Sea (Pleistocene) barrier island system (Yon and Puri, 1962; Puri et al., 1967), range from 80 to 100 feet (24.4 to 30.5 meters) above MSL. White (1970) believed that the Bell Ridge is an outlier of the Brooksville Ridge, to which it is roughly parallel. Because the sand hills of the Bell Ridge overlie karstic Ocala Limestone, the former extent of the ridge may be obscured by dissolution and collapse of the underlying limestone (Puri et al., 1967).

The Williston Karst Plain, located on the eastern flank of the Brooksville Ridge, extends eastward to the Alachua Karst Hills (Figure 1) and is underlain by the Ocala Limestone (Scott, in preparation). It merges to the north with the Branford Karst Plain and Chiefland Karst Plain. Elevations of the Williston Karst Plain range from 50 feet (15.2 meters) to 100 feet (30.5 meters) above MSL. A few outlier hills, composed of weathered Hawthorn Group sediments, are present within this area and locally may exceed 150 feet (45.8 meters) in elevation. Although much of the plain is well drained, a number of springs occur within this area, mainly along the Santa Fe River.

White (1970) divided the Brooksville Ridge into northern and southern sections. Part of White's northern section extends into the southeastern portion of the study area. Elevations along this part of the Brooksville Ridge range from approximately 50 feet (15.2 meters) to greater than 150 feet (45.8 meters) above MSL. Topographically, this region exhibits low, rolling karst hills interspersed with moderately-shallow sinkholes. Well-developed sand dunes are often present on the flanks of the ridge. Numerous shallow lakes and ponds are present in the Brooksville Ridge as a result of clayey Pleistocene sediments and weathered Miocene Hawthorn Group sediments acting as confining units for the underlying Ocala Limestone. The ridge is bounded by the Waccasassa Flats to the west, where a distinct erosional escarpment at elevations of approximately 70 feet (21.3 meters) to 75 feet (22.9 meters) MSL provides a line of demarcation between the two features (Col et. al., 1997).

The Alachua Karst Hills extend from Columbia County to Central Alachua County with elevations from approximately 100 feet (30.5 meters) to an excess of 200 feet (61 meters) above MSL (Scott, in preparation). The karst hills are well drained and formed in response to karstification of uplands covered by Hawthorn Group sediments and undifferentiated sediments.

The study area is blanketed by a veneer of Quaternary sediments and soils. For this reason, and in keeping with geologic mapping practices developed by Scott et al. (2001), the authors have adopted the policy of mapping the first named geologic unit within 20 feet (6.1 meters) of the surface. If undifferentiated Quaternary (Qu) sediments attain a thickness greater than 20 feet (6.1 meters), then they appear as the mapped unit. If the Quaternary sediments are less then 20 feet (6.1 meters) thick, then the underlying stratigraphic unit appears on the map.

The Eocene to Miocene units exposed in the study area have regional stratigraphic significance, and have been identified, correlated, and interpreted in many different ways in the literature. Some previous investigators relied heavily on fossils to establish formations and correlate facies within this region, a practice which has led to some confusion regarding lithostratigraphy. Figure 2 on the accompanying plate demonstrates the different nomenclature that some of these units have had in the past, as well as showing pictures of important fossils useful in identifying the units. Summaries of previous work on units in this area can be found in Vernon (1951), Vernon and Puri (1956), Puri et al. (1967), and Scott et al. (2001).

The Avon Park Formation (Tap) is a Middle Eocene carbonate unit (Applin and Applin, 1944; Miller, 1986) present in peninsular Florida and is the oldest subsurface stratigraphic unit encountered in the present study. The lithology of the Avon Park Formation in the study area is typically a cream to light brown to tan, very fine to medium grained, poorly indurated to well indurated, variably fossiliferous limestone (wackestone, packstone, and grainstone). It is often interbedded with tan to brown, very poorly indurated to well indurated, very fine to medium crystalline, (fossil) moldic and vuggy dolostone. Where preserved, fossils in this unit commonly include benthic foraminifers, echinoids, algae, and carbonized plant remains (Figure 2).

The upper surface of the Avon Park Formation is irregular due to karstification. The study area lies over the eastern flank of the Ocala Platform, where the Avon Park sediments are at the surface or at relatively shallow depths compared to the rest of the state. The Avon Park Formation is unconformably overlain by the Ocala Limestone. Near the contact, there is commonly a mixing of the two lithologies as well as common occurrences of organic-rich and weathered sediments.

The top of the Avon Park Formation ranges from 35 feet (10.7 meters) below MSL in W-6418 (cross section D-D'), to 175 feet (53.3 meters) below MSL in W-18536 (cross section A-A'). None of the cross sections fully penetrated the Avon Park Formation, but just east of the study area, near the town of Alachua, the Avon Park Formation has a thickness ranging from 725 feet (221.0 meters) to 825 feet (251.5 meters) in wells W-1486 and W-1465 respectively (Williams et al., 1977).

The Upper Eocene Ocala Limestone (To), first described by Dall and Harris (1892), is a biogenic marine limestone comprised largely of foraminifera, molluscs, echinoids and bryozoans. Based on lithologic differences it can be informally subdivided into an upper and lower unit (Scott et al., 1991). This subdivision, while often apparent in cores and quarries, is difficult to ascertain in cuttings. As a consequence of this, the geologic cross sections do not break out the upper and lower Ocala Limestone.

The upper unit is typically white to cream, fine to coarse grained, poorly to well indurated, poorly sorted, very fossiliferous limestone (wackestone, packstone, and grainstone). Fossils commonly include large foraminifers, bryozoans, mollusks, and a rich diversity of echinoids. The lower unit is typically a white to cream, fine to medium grained, poorly to moderately indurated limestone (grainstone to packstone). The unit may be partially dolomitized. Fossils include miliolids, smaller foraminifera, bryozoans, algae, mollusks, and echinoids. For detailed photographic examples of fossil types, consult Figure 2 on the accompanying plate.

Portions of the upper Ocala Limestone have been locally replaced by silica and upon erosion, large boulders may remain as residual float. Chert is often seen in fractures and joints in caves and within quarries. The most likely source of silica is from weathering of the Hawthorn Group sediments (Williams et al., 1977). There are several processes that have occurred, or are occurring, in the Hawthorn Group which release silica in solution and provide a source for silica in the replacement of carbonate rocks (Altshuler et al., 1963; Mitchell, 1965; and Assefa, 1969). The occurrence of this float throughout the study area is an indication that the Hawthorn Group once covered much more of the study area and has been subsequently removed by erosion and weathering.

The top of the Ocala Limestone ranges from 5 feet (1.5 meters) above MSL in W-18426 (cross section B-B'), to 80 feet (24.4 meters) above MSL in W-18536 (cross section A-A'). The Ocala Limestone ranges from 55 feet (16.8 meters) thick in well W-18426 (cross section B-B') in the southwestern part of the study area to 250 feet (76.2 meters) thick in well W-18536 (cross section A-A') in the eastern portion of the study area. The Ocala Limestone is unconformably overlain by undifferentiated Quaternary sediments (Qu) in the western and central portion of the study area, by the Coosawhatchie Formation of the Hawthorn Group (Thc) in the northeastern portion of the study area, and undifferentiated Hawthorn Group (Th) sediments in southeastern portion of the study area.

The upper surface of the Ocala Limestone is heavily karstified (see photo 3) and several wells in the geologic cross sections are believed to have been drilled into karst features. Data gathered from field work indicates that the following wells: W-16593 (cross section A-A'), W-16537 (cross section C-C') and W-16880 (cross section D-D') were likely drilled into sinkholes.

Due to erosion and dissolution, the Oligocene Suwannee Limestone (Ts) is not found in place within the study area. Silicified residual boulders of the Suwannee Limestone, however, are commonly found in the area north of the Santa Fe River, indicating that it once covered much of the northern portion of the study area. These float boulders contain numerous molds of the echinoid *Rhyncholampas gouldii*, an index fossil for the Suwannee Limestone.

The Miocene Hawthorn Group is composed of a number of different formations and members. The reader is referred to Scott (1988) for a complete discussion of the unit. Hawthorn Group sediments are encountered only in the eastern portion of the study area, where they unconformably overlie the Ocala Limestone. Miocene sediments of the Hawthorn Group are thought to have been deposited onto the platform, but Post-Miocene erosion removed sediments from the crest of the Ocala Platform exposing the Eocene carbonates (Cooke, 1945; Pirkle, 1956b; Espenshade and Spencer, 1963; Brooks, 1966; and Scott, 1981). Fossils in the Hawthorn Group are sparse but may include vertebrate remains, corals, and mollusks. Williams et al. (1977) reports that the most commonly found fossils are oysters and coral heads. Silicified coral heads have been observed in hill exposures and stream beds in northwestern Alachua County by numerous authors (Dall and Harris 1892; Williams et. al., 1977).

In the study area, sediments of the undifferentiated Hawthorn Group (Th) and the Coosawhatchie Formation of the Hawthorn Group (Thc), are the only Miocene units recognized. The undifferentiated Hawthorn Group (Th) sediments occur at or near the surface in eastern Gilchrist County and western Alachua County and are associated with the Brooskville Ridge (Figure 1). These sediments are typically weathered blue-gray to reddish-brown clayey sands, to silty clays and pure clays with relatively little phosphate. On the eastern flank of the Brooksville Ridge (Figure 1), numerous hard rock phosphate mines were historically associated with these sediments. These phosphate deposits were formed by weathering and dissolution of phosphate in the Hawthorn Group and re-precipitation in karst features (Scott, 1988).

The Coosawhatchie Formation (Thc) is only present along the eastern edge of the study area and consists of gray to bluish-gray sandy clay or clayey sand with phosphate grains, and calcitic to dolomitic carbonates. Lenses of relatively pure quartz sands, clays or limestone are not uncommon. This unit is lithologically variable and beds may pinch out and interfinger both laterally and vertically. Outcrops of Coosawhatchie Formation in the study area are typically very weathered and consist of reddish-brown to white, clayey, calcareous quartz sands to sandy clays with leached phosphate grains and limonitic and calcareous pebbles.

The top of the Hawthorn Group ranges from 35 feet (10.7 meters) above MSL in W-16663 (Th, cross section B-B'), to 180 feet (76.2 meters) above MSL in the eastern portion of the study area (Thc, cross section A-A'). The Hawthorn Group ranges from 30 feet (9.1 meters) thick in well W-16663 (cross section B-B') to over 100 feet (30.5 meters) thick in the eastern portion of the study area. The Hawthorn Group is unconformably overlain by undifferentiated Quaternary sediments (Qu).

Undifferentiated Quaternary sediments (Qu) lie unconformably on either the Eocene Ocala Limestone (To), the Coosawhatchie Formation of the Hawthorn Group (Thc), or undifferentiated Hawthorn Group sediments (Th), throughout the study area. These sediments generally consist of sandy clays and clayey sands, aeolian dune sands, and often include weathered and silicified boulders of the Ocala Limestone and Suwannee Limestone. There is a very localized fresh-water marl deposit which can be seen along the Santa Fe and southern Ichetucknee Rivers (Figure 2). Due to its limited aerial extent and minimal thickness (typically less than six feet; 1.8 meters), this unit was not mapped.

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SELECTED PHOTOGRAPHS FROM STUDY AREA

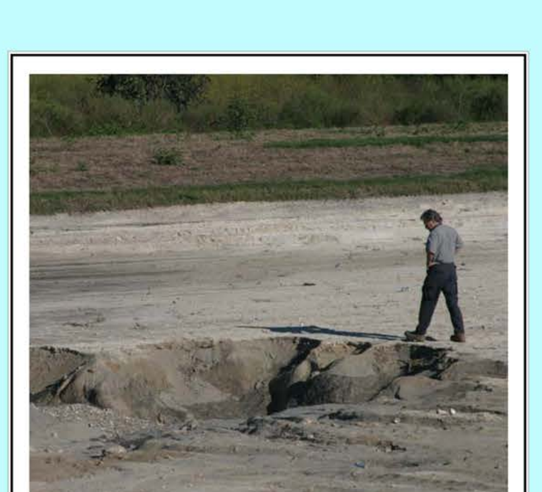

Photo 1. William L. Evans III investigating sinkhole formed in stormwater retention pond. Failure of pond integrity due to karst is common in area. Pond located at: T. 10 S., R. 17 E., S. 03, NW 1/4 of NE 1/4. Photo by Richard C. Green

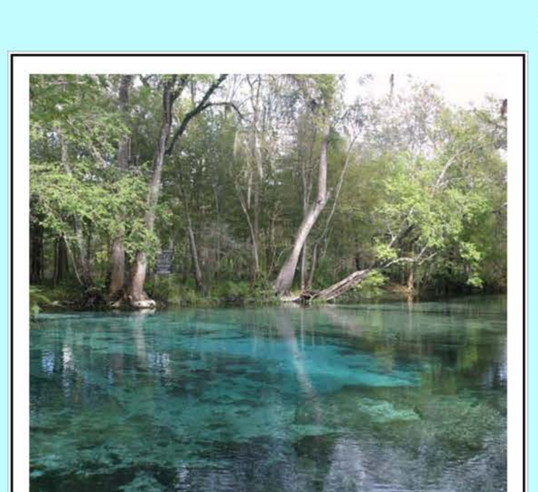

Photo 2. Ginnie Springs. A privately-owned second magnitude spring located along the Santa Fe River. Spring is located at T. 07 S, R. 16 E, S. 34, SE 1/4 of NW 1/4. Photo by Richard C. Green.

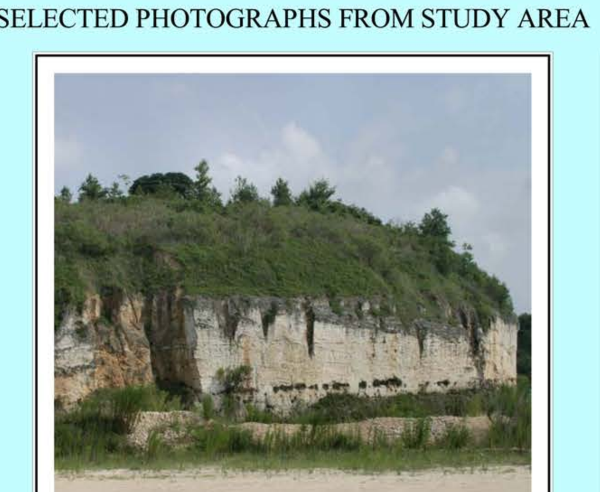

Photo 3. Paleo-karst features in abandoned quarry. Limestone wall is approximately 8 meters (26.3 feet) high. Quarry located at: T. 09S, R. 17 E, S. 35, NE 1/4 of NE 1/4. Photo by Richard C. Green

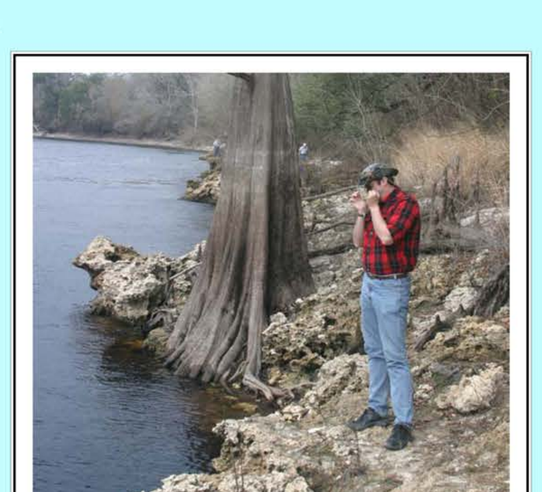

Photo 4. Richard C. Green examining exposure of Ocala Limestone along the east bank of the Suwannee River at: T. 06 S, R. 13 E., S. 07 Photo by David T. Paul

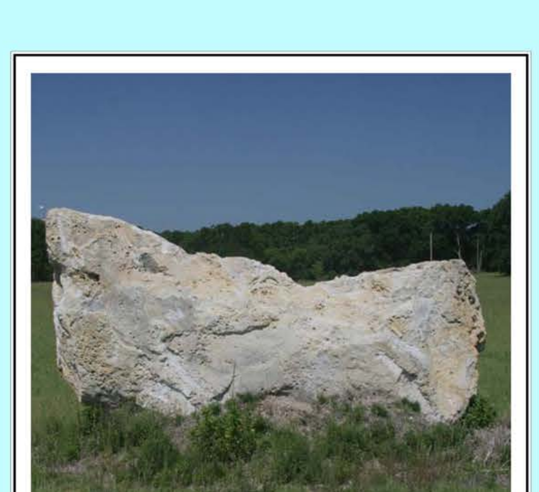

Photo 5. Large float boulder of Suwannee Limestone measuring approximately 2 meters (6.6 feet) tall by 4 meters wide. Sample located at: T. 08 S, R. 17 E, S 09, NE 1/4 of NE 1/4. Photo by Richard C. Green