Quaternary Stratigraphy along the Gulf Intracoastal Waterway, Walton and Bay Counties, Florida

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Quaternary Stratigraphy along the Gulf Intracoastal Waterway, Walton and Bay Counties, Florida

A Field Trip of the Southeastern Geological Society in cooperation with the Florida Geological Survey, Tallahassee; the Choctawhatchee Basin Alliance, and Mattie M. Kelly Environmental Institute, Northwest Florida State College

12 October 2013

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Introduction to Fieldtrip and Acknowledgements
This SEGS fieldtrip was held in conjunction with the 6th Annual Mattie M. Kelly Environmental Institute Symposium on Choctawhatchee Bay, hosted by the Mattie M. Kelly Environmental Institute at Northwest Florida State College (see the MKEI website at: www.nwfsc.edu/MattieKellyInstitute/env-index.cfm). The scientific symposium was on Friday, 11 October 2013, in the Science Department of Northwest Florida State College (www.nwfsc.edu/). Geology has not been a prominent subject in past MKE symposia, so SEGS Fieldtrip Participants were invited to attend the symposium and to submit oral or poster presentations on general or specific topics on Florida geology, especially if they are relevant to coastal or estuarine environments.

The exposures along the Gulf Intracoastal Waterway (GIW) in Walton and Bay counties were first brought to my attention years ago by Mr. Ben Fergusson of Freeport, Walton County, Florida. Ben has many talents and frequently demonstrates and teaches traditional arts such as blacksmithing. He has also been observing and collecting fossils and artifacts in the Florida panhandle and southern Alabama for many years, and has an uncanny ability to see patterns and make associations in the field, particularly with regard to geomorphic features and the probable location of archaeological sites. I am always amazed at his observations and have frequently taken notes during and after our many conversations on the regional landscape and geology of the central Gulf Coast area.

Early reconnaissance of the GIW was made possible by the staff and resources of the Choctawhatchee Basin Alliance (CBA), particularly Julie Terrell, Allison McDowell, and Sarah Schindele, who have made several excursions up the GIW to explore these outcrops. The CBA is assisting once again with this SEGS fieldtrip. Mr. Guy (“Harley”) Means, Assistant State Geologist at the Florida Geological Survey, has generously made available his time and an FGS vessel for the trip. Harley and Bryan traversed the GIW from West Bay to Choctawhatchee Bay on 6 September 2013, making field observations and taking photos for this field guide. Dr. Allison Beauregard, Chair of the Mattie M. Kelly Environmental Institute at Northwest Florida State College, enthusiastically agreed to coordinate this SEGS fieldtrip with the annual MKEI Scientific Symposium on Choctawhatchee Bay. Pamela Hynes and Steve Fielding of the NWFSC Learning Resource Center ably researched some obscure historic references, and rapidly retrieved many inter-library loan requests during the writing of this field guide. Sarah Schindele of the Choctawhatchee Basin Alliance wrote the much-appreciated chapter on coastal dune lakes. Julie Terrell gave valuable logistical advice in preparation for this excursion. And Allison McDowell kindly coordinated the rental of pontoon boats. Many thanks to these friends and colleagues who have all contributed in various ways to make this trip possible!

~Jon Bryan
Schedule and Driving Directions

The field trip will rendezvous at 8:00 AM (Central Standard Time) in the parking lot of the South Walton Center of Northwest Florida State College, located at 109 Greenway Trail, US-331/SR-83, Walton County. This branch campus is located only ~0.7 mile north of US-98, on US-331. From there, we will proceed about 6 miles to Point Washington Boat Ramp in south Walton County (take US-331 south, to US-98 east, to CR-395 north, to boat ramp). Boat trip estimated at 3 hours.

The West Bay to Choctawhatchee Bay Section of Gulf Intracoastal Waterway

The Gulf Intracoastal Waterway (GIW) is a segment of the larger Intracoastal Waterway system—a federally-maintained, toll-free shipping route serving United States coastal areas along the Atlantic Ocean and the Gulf of Mexico. It utilizes sounds, bays, lagoons, and dredged canals, and is also connected to inland waterways in many areas, as in the Great Lakes and much of the Mississippi River Basin. The GIW segment extends from Apalachicola Bay, Florida, to the U.S.-Mexican border at Brownsville, Texas, a distance exceeding 1,000 miles.

The West Bay to Choctawhatchee Bay (WB-CB) section of Gulf Intracoastal Waterway will be visited during this fieldtrip (Figure 1). It extends from West Bay in Panama City to Choctawhatchee Bay, and emerges near the Choctawhatchee River mouth/bay head delta located at the eastern end of the estuary. The WB-CB section was opened on 27 April 1938. In a history of the GIW published by the Army Corp of Engineers, Alperin (1983, p. 16) summarizes the excavation of the WB-CB section of the GIW:

First authorized in 1935, the project for the reach between West Bay and Choctawhatchee Bay proved to be the most troublesome. Extending about 26 west miles from the 10-foot contour in West Bay to the same depth roughly 3 miles out in Choctawhatchee Bay, the canal cut through territory composed of almost pure sand. The land cut began about 7 miles west of the starting point as the channel left West Bay Creek and ran a northwestward inland course. At 15 miles west of the starting point, the ground elevation had risen from 10 feet below sea level to a height of 40 feet above mean low tide, at which peak it continued for another 4 miles before gradually descending to the 10-foot depth in Choctawhatchee Bay. In other words, for a distance of 4 miles, the sandy banks of the canal loomed 50 feet above the bottom of the 10-foot channel. This section became known in local parlance as the "little Grand Canyon."

Fortunately for geologists, the “little Grand Canyon” has preserved a respectable coastal section of up to 50 feet of Quaternary strata in a boat-accessible outcrop.

Overview of the Coastal Geology of the Florida Panhandle and Study Area

The entire coast of the Florida panhandle consists of Quaternary strata of the eastern Gulf of Mexico Coastal Plain and the Florida Platform, and lies within the Gulf Coastal Lowlands of the Southern Pine Hills Geomorphic District, and the Lower Delta Plain of the Apalachicola Delta Geomorphic District (see Scott, 2005; Brooks, 1981). The modern shore is composed of Holocene siliciclastic sediments consisting of very nearly pure quartz sands with minor heavy mineral
sands, which mantle Late Pleistocene beach and barrier landforms of similar sedimentological composition. By any measure, the sugar-white beaches of the Florida panhandle are among the most attractive of any coastline in the world, and tourism in northwest Florida will always be indebted to this natural gift of pure quartz sand!

Coastal landforms in the Florida panhandle include barrier islands (e.g., Santa Rosa Island), beaches, beach ridge plains (e.g., St. Vincent Island), dunes, dune lakes, sand spits (e.g., St. Joseph Peninsula), coast-parallel peninsulas/barrier spits (e.g., Moreno Point), bays, lagoons, drowned river valley estuaries (viz., Pensacola Bay, Choctawhatchee Bay, St. Andrews/West-North-East Bays), and bar-built estuaries (Apalachicola Bay). Landward of the coastal rim of Holocene siliciclastic sands are surficial, undifferentiated Quaternary sediments of coastal, shallow marine, or alluvial origin (Scott et al., 2001). Pleistocene and Holocene coastal sediments and landforms of the Florida panhandle have been the subject of a great volume of research in sedimentology, coastal and nearshore processes, geomorphology, paleoclimatology, and sea level studies (e.g., Schnable & Goodell, 1968; Stapor, 1975; Otvos, 1992; Donoghue and Tanner, 1992; Kish and Donoghue, 2013; Das et al., 2013; Balsillie and Donoghue, 2004, 2009).

The surface geology of the West Bay to Choctawhatchee Bay section of the GIW (referred to hereafter simply as the GIW) is mapped as Quaternary undifferentiated (Qu) by Scott et al. (2001; see Figure 2). Otvos (1991, fig. 1) maps the GIW area as Prairie Formation (a Pleistocene alluvial unit) or Prairie Formation correlative, with most of the coastline (exclusive of Holocene-
age spits and barrier islands) mapped as the Gulfport Formation (a Pleistocene barrier island complex). The Prairie and Gulfport formations were named from strata in the coastal Mississippi region, but Otvos has applied these formation names eastward across the entire panhandle of Florida, as far as Ochlockonee Bay in Franklin County. Neither formation, however, has been adopted for official use by the Florida Geological Survey, nor have they been widely used generally by Florida geologists. Among other things, there is concern over the extension of Mississippi River coast lithosomes so far east onto the relatively stable Florida Platform (Donoghue et al., 1998).

Figure 2—Portion of the Geologic Map of the State of Florida (Scott et al., 2001), showing the Intracoastal Waterway (the gray line above IW) between Choctawhatchee Bay (CB) and West Bay (WB). Qh, Quaternary Holocene; Qu, Quaternary undifferentiated; Qal, Quaternary alluvium; Tci, Tertiary Citronelle Formation; Tab, Tertiary Alum Bluff Group.

The GIW was dredged through a relatively flat, undissected, and poorly-drained surface between Choctawhatchee Bay and West Bay, with relict coastal surface elevations averaging between 30-40 feet (see USGS Point Washington and Seminole Hills quadrangles), with up to 50 feet of stratigraphic section preserved in outcrop. This area of comparatively high coastal relief might be considered a sort of coastal “inlier” because it was unaffected by the creation of the drowned river valleys to the west (Choctawhatchee Bay) and east (West Bay) during the Holocene Transgression (i.e., the post-glacial eustatic sea level rise of nearly 400 feet, from 18-6 ka). Much of this Quaternary section extends westward and eastward to form the coast-parallel peninsulas of Moreno Point and Panama City Beach. Martens (1931) long ago commented on the high coastal ground and absence of coastal marshes in this area, as have Balsillie and Clark (2001), who further noted the extensive and high dune fields in Walton County, which they interpret as eolian accretion over a Pleistocene barrier complex that extends westward to Escambia County, Florida.

Otvos (1992, 2004a) also documents a Late Pleistocene (Wisconsin)-Holocene sand sheet and semi-continuous dune field reaching from Mobile Bay, Alabama, to Ochlockonee Bay, Florida,
and has mapped parabolic, shore-transverse, and shore-longitudinal dunes in this relict coastal
dune field. Some of the more prominent dunes along this transect include Royal Bluff, near
Carabelle, Franklin County, Florida; and the rather spectacular dune along the southern shore
of Pensacola Bay on the Santa Rosa peninsula, at Naval Live Oaks Reservation, east of Gulf
Breeze, Santa Rosa County, Florida, which reaches nearly 60 feet above MSL (see Bryan et al.,
2008, p. 116; also Froede et al., 2006). But the more completely-preserved dune fields are to be
found in Walton County, Florida, between Miramar Beach and Grayton Beach, just to the south
of the western portion of the GIW. They are especially prominent in the area between Oyster
Lake/Dune Allen Beach and Draper Lake/Blue Mountain Beach. Blue Mountain reaches 74 feet
above MSL (USGS Grayton Beach Quadrangle). These dunes are mapped as part of the Gulfport
Formation by Otvos, and he reports (Otvos, 2004a, 2005b) thermoluminescence (TL) and optical
luminescence (OSL) dates of ranging between 66 to 5 ka, which reflects dune accretion from the
latest Pleistocene into the early Holocene.

Stratigraphy of the Gulf Intracoastal Waterway
Other than the report of Yon and Hendry (1969), there is almost no reference in the literature to
the exposures along the GIW. The following stratigraphic section was measured and collected
during a fall of 2011 Northwest Florida State College historical geology class fieldtrip, and is
considered representative of the GIW. The descriptions are summarized from field notes,
laboratory observations (using a binocular dissecting scope), and sieve analysis (class project).

| Site IW-8 |
| Location: Gulf Intracoastal Waterway, southern Walton County, Florida |
| Date: Friday, 7 October 2011 |
| Formation(s): Quaternary (undifferentiated); ~53 feet of section exposed |
| Comments: Measured section from water level to top using Jacob staff with compass mount for leveling. Section chosen due to maximum, continuous, accessible exposure up section. Although the lowest strata at this location is mostly covered, it is exposed elsewhere along the GIW. See Water-Logged – A Field Guide to Sections. |

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Bed 4 7.2 - 16.2 m</td>
<td>Very pale orange (10YR 8/2) to pale yellowish brown (10YR 6/2), to dark yellowish brown (10YR 4/2), sub-angular to sub-rounded/rounded, medium to coarse/well-to- moderately sorted quartz sand; some clay, humate, plant fibers, heavy minerals (?); some coarse quartz sand grains frosted; many large, dried sticks/logs at the 11.5 m level (and laterally at this level along the outcrop); large scale cross-stratification visible in outcrop along GIW within Bed 4. Facies: Reworked beach and migrating coastal dune/sand sheet.</td>
</tr>
<tr>
<td>Bed 3</td>
<td>Dark yellowish brown (10YR 2/2), sub-rounded to rounded, well-sorted, coarse</td>
</tr>
</tbody>
</table>
5.0 - 7.2 m  (>70% by volume in 500 microns to 1 mm pan), humatic quartz sand (some humate in small fragments); top of Bed 3 at 7.2 m is marked by a conspicuous bench which marks the distinct top of black humate-rich sand and the overlying white sands. Facies: Beach/barrier.

“Bed 1” (covered)/Bed 2

0.0 (water level)  Grayish brown (5YR 3/2), pale brown (5YR 5/2), and pale yellowish brown
- 5.0 m  (10YR 6/2), sub-angular to sub-rounded, well-sorted/medium (60-75% by volume in 250-500 microns pan), humatic quartz sand; some coarser sand grains (@ 3.0 m) more rounded; common Ophiomorpha burrows; 0-1.5 m is covered at this section, but both Ophiomorpha-rich humate sands and peat are found at water level in some exposures along the GIW. Facies: Shoreface/beach-barrier/marsh. Lacustrine/fluvial influence with peat beds.

Correlation of Beds 1, 2, 3. While the GIW has been mapped as undifferentiated Quaternary (Qu) by the Florida Geological Survey (Scott et al., 2001), the section is easily correlated to the stratigraphy documented by Otvos in this region. The lower part of the GIW section (Beds 1, 2, 3), containing humatic and Ophiomorpha-bearing quartz sands, matches the description of the Gulfport Formation, a coastal barrier and mainland beach unit of Sangamonian age named and mapped by Otvos from Gulfport, Mississippi, to Ochlochonee Bay, Franklin County, Florida (Otvos, 1992). Beds 1-3 of the GIW appear to be identical to the beach ridge strandplain surface exposure of the Gulfport Formation preserved at Belle Fontaine Beach, Mississippi (Otvos, 2005a). This surface would also seem to be equivalent (in elevation and lithology) to the Quaternary beach ridge and dune (Qbd) surface of Scott et al. (2001) mapped in coastal Escambia, Santa Rosa, Gulf, and Franklin counties. Otvos (1992) effectively maps the panhandle Qbd surface of Scott et al. (2001) as Gulfport Formation. Likewise, Donoghue and Tanner (1992, p. 236) describe the Qbd surface beach ridge plain near Port St. Joe in Gulf County as Sangamonian in age, and overlying humate deposits (this is the Sangamon beach ridge surface of von Drehle, 1973). This same beach ridge surface is mapped as the “upper sequence Pleistocene” by Schnable and Goodell (1968, p. 7, 38-39), and the Escambia Sequence of relict shoreline features by Winker and Howard (1977). Stapor (1975) documents a Holocene scarp/shoreline cut into Sangamonian humatic sands along the Apalachicola delta across coastal Franklin County, and reports that similar scarped humate sands are intermittently exposed from Mobile Point, Alabama, to Alligator Point (Franklin County), Florida, a distance of 400 km. These sands are evidently also part of the Qbd surface of Scott et al. (2001), and the Gulfport Formation of Otvos.

Otvos (2005b) reports thermoluminescence (TL) and optical luminescence (OSL) dates of 124 ± 32.1 ka for the Gulfport Formation at Belle Fontaine Beach, Mississippi; and 116.1 ± 9.1 ka for the large Gulfport dune at near Gulf Breeze, Florida. This would indicate a deposition of the Gulfport during the Sangamon Interglacial Stage (generally dated between 80-130 ka), during which time sea level was between 3 to 5 meters above present sea level. Assuming equivalence with the Gulfport Formation, Beds 1, 2, and 3 in the GIW section preserve beach to shoreface conditions during the Sangamon Interglacial, and perhaps also the formation of the Pamlico Terrace. A few marine molluscs (ostreids, Mercenaria, Chione) were collected under the SR-79
bridge at the West Bay boat ramp that appear to have come from this sandy unit (which overlies a peat bed at water level), but this needs to be confirmed elsewhere in the section.

**Correlation of Bed 4.** The top 9 meters of the GIW section (Bed 4) appear to be primarily (if not exclusively) a dune facies, with abundant, buried sticks/logs and large-scale cross-stratification. This is correlated herein to the Wisconsin-to-Holocene eolian sand sheet and dune field documented by Otvos and discussed previously, which extends from Mobile Bay, Alabama, to Ochlockonee Bay, Florida, and consistently overlies the beach/barrier sands of the Gulfport Formation (Otvos, 2004). Otvos (2004a, 2005b) reports OSL and TL dates for coastal dunes within this sand sheet ranging from 6 to 53 ka, reflecting accretion from the Latest Pleistocene (Wisconsin Stage) into the Early Holocene. This Wisconsin-Holocene eolian sand sheet is probably much broader, and most likely includes much of the area mapped as undifferentiated Quaternary (Qu) by Scott et al. (2001) in Escambia, Santa Rosa, Okaloosa, Walton, and Bay counties. The Valparaiso-Niceville area, for example, along the northwestern shore of Choctawhatchee Bay, is clearly a relict dune field with steep, rolling terrain and narrow steephead ravines. Sand borrow pits and jeep trails expose thick, well-sorted, fine-medium sands.

**Note on “Citronelle Cover Sands”**. Over most of the Florida panhandle, the Pliocene-age Citronelle Formation is well-exposed (see Scott et al., 2001; see Means, 2009 for a recent study on the Citronelle), and typically overlying the Citronelle is a tan to yellow, rounded, medium quartz sand, presumed to be eolian in origin (Figure 3). This unit, informally called the “Citronelle cover sands” by Otvos (2004a), can reach up to 5 meters or more in thickness. Otvos (2004a, b) reports OSL dates for Citronelle cover sands of 66.0 \(\pm\) 5.0 ka in Pensacola, and 37.0 \(\pm\) 5.0 ka at Mossy Head (Walton County). It seems likely that the Citronelle cover sands are contiguous with the more coastal Qu eolian sand sheet described above. Note also that sand deposits less than 20 feet thick are conventionally not mapped as discrete lithostratigraphic units on the Florida state geologic map (Scott, 2001). So the Wisconsin-Holocene sand sheet may form a very extensive, basically unmapped, deposit that reflects arid to semi-arid conditions through the Pleistocene-Holocene transition. Inland eolian dunes of this age have been documented from Louisiana (Otvos and Price, 2001), the coastal plain of Georgia (Ivester et al., 2001), and the Florida peninsula (White, 1958, 1970; Bryan et al., 2008). A regional correlation and mapping of this sand sheet would be of great interest, and may warrant recognition as a formal lithostratigraphic unit.

**Note on Marine Terraces**. If this interpretation is correct, then the late age of the eolian sand sheet raises critical questions regarding the legitimacy of some of the coastal terraces of Healy (1975) and others (MacNeil, 1949). Four marine terraces are mapped by Healy (1975) in the GIW area; the Silver Bluff (<10 feet), along the southern shore of Choctawhatchee Bay; the Pamlico (8-25 feet) in the middle section of the GIW; the Talbot (25-42 feet), and perhaps the Penholoway Terrace (42-70 feet). The Pamlico Terrace seems to be a shallow coastal sea bottom and coastline,
and may equate to the Gulfport-Qbd surface as discussed above. But terraces are geomorphic features that obviously cannot be older that the strata in which they are formed. Thus, if the Gulfport-Qbd surface (Beds 1, 2, and 3 of the GIW) is covered by younger, eolian sands, then the sand sheet cannot also be the location of older Pleistocene terraces (e.g., the Talbot or Penholoway terraces, which are mapped around Choctawhatchee Bay). And if the Citronelle cover sands are Late Pleistocene to Holocene in age as well, this would require a reconsideration of even higher terraces to the north/northwest of the study area where higher terraces may be mapped on the Citronelle cover sands.

Figure 3—Citronelle Formation and overlying “Citronelle Cover Sands” as see at Borrow Pit B-43, Eglin Reservation, Niceville, Okaloosa County, Florida. Photo: J. Bryan.

More on Humate and Humatic Sands

According to Swanson and Palacas (1965), humate is a dark-brown to black, water-soluble organic material derived from the decomposition of plant debris (humus) in soils or in standing bodies of water, as in wetlands, lakes, or bays. Chemical leaching of decaying humus produces an extract of dissolved and colloidally-dispersed humic substances that include several molecular varieties (e.g., various acids, tannins, carbohydrates, lignins). This solution creates the well-known tea-colored surface waters, or “blackwater”, so commonly found in northern Florida bogs, marshes, lakes, streams, and rivers.

The soluble humic substances are transported by surface or groundwater to areas where they are precipitated or flocculated when coming into contact with brackish or saline water, forming humate. Humate is a semi-lustrous, gel-like, powdery material that coats sand grains and may form a cement (for sandstone) and/or matrix between sand grains. Although once postulated as a source of asphalt (pitch/tar/kerogen) and even crude oil (e.g., Haseman 1921, 1930), humate is chemically related to lignin, peat, and coal, rather than hydrocarbons. Handling humatic sands quickly results in very “dirty”, “working-in-the-garden”, blackened hands. Swanson and
Palacas (1965, B14) claim that humate-stained hands cannot be washed clean in brackish bay water, but rinsing them in fresh stream water “successfully removes the stain”.

Humate is apparently the same as, or is similar to, the “sap brown” described by Teas (1921) from Charlton County, Georgia, on Trail Ridge (also reported in Haseman, 1921), and has been used in the manufacture of brown paper dyes, pulpwod stains, van dyke brown pigment, paints, and ink. According to Teas (1921, p. 373), “Prior to 1914, Germany supplied all the sap brown used in the United States, but during the war it was necessary to find a source in this country. A small plant has been in operation at Haseman, Florida, where a small deposit of about 100,000 tons of the ore occurs.” The exact location of “Haseman, Florida” is not clear from the older articles. Haseman (1921, p. 75; 1930) locates it “…on a bluff of Choctawhatchee Bay about 60 miles east of Pensacola” and states that, “The deposit extends out from underneath the twenty foot bluff of beach sand into the brackish water bay, and it is almost surrounded on its rear or land side by a large freshwater lake and freshwater swamps.”

Swanson and Palacas (1965, B4-B5) locate Haseman’s humate locality “about 1.8 miles east of Shalimar, due east of the center of sec. 4, T.2 S., R.23 W.” This would be along the shoreline of Choctawhatchee Bay and roughly ½ mile north of Lake Lorraine, which is presumably the large freshwater lake mentioned by Haseman. There is also 15 to 20 feet of relief along the shore in the Lake Lorraine area, as mentioned by Haseman (USGS Fort Walton Beach Quadrangle 1970, photo-revised 1976). Lake Lorraine is now connected to Choctawhatchee Bay and is also located next to a cuspathe shore called (significantly) Black Point. The Shalimar/Lake Lorraine/ Black Point area was once called Port Dixie. Black Point is also the former location of a silhouette battleship target used in 1943 (Angell, 1944, p. 102).

An official U.S. Army Air Forces history of Eglin Field (Angell, 1944) mentions what was evidently the “Haseman” dye plant (parenls mine): “During the war, before the expulsion of Von Papen (i.e., Franz von Papen, German nobleman, Chancellor and Vice-Chancellor of Germany in the early 1930’s; expelled from the United States in 1915 for suspected sabotage operations against the U.S.), 130 Germans operated a ‘dye’ plant at Port Dixie, actually an explosive factory and probably a submarine base as well. Costly machinery was smashed when they fled and the records were thrown into Garnier’s Bayou.” The source cited for this information is the 28 August 1928 edition of the Valparaiso Star, a weekly paper published during the 1920’s (although the 28 August 1928 date appears to be incorrect). This story was repeated in a 1955 edition of the Playground News, a Fort Walton Beach paper (Playground News, 1955) (now the Northwest Florida Daily News). Although the submarine base seems like a stretch, Swanson and Palacas (1965, B5) note that this area is “locally known as the old dye-plant quarry”. Northwest Florida State College recently received a sample of humatic quartz sand from the Heritage Museum of Northwest Florida (Valparaiso) with the following label:

Black Earth
In addition to its former use in the manufacture of dyes, stains, pigments, paints, and inks, humate has adsorptive properties. Swanson et al. (1966) report experiments that demonstrate the metal sorption qualities of humate powder and suggest a potential economic value, as in fertilizers or animal feeds. Humate readily sorbs cobalt, copper, iron, manganese, molybdenum, and zinc, all of which are essential plant micronutrients. They calculate that within 35 feet of the surface, there is 100,000 to 1,000,000 tons of humate per square mile over 300-500 square miles along the northern Gulf Coast.

The Geological Significance of Humate. Yon and Hendry (1969) report on the humatic sand exposures along the GIW, with maximum thicknesses of 15 feet, and also note its presence in various localities around the perimeter of Choctawhatchee Bay, and common occurrence in augers and cores in southern Walton County. Thinner (3-6-inch) layers of humate or hardpan are also found at many localities around Choctawhatchee Bay. With the exception of outcrops along the northern shore of Choctawhatchee Bay at Choctaw Beach (Figure 4), there are now few natural exposures of humatic sand in the area. A recent search (10 June 2013) for most of the field localities of Swanson and Palacas (1965) around Choctawhatchee Bay confirmed that most are now on private property and generally inaccessible, or otherwise covered with rip-rap, seawalls, or quartz sand. There is a coastal vacant lot directly across from Shalimar Point Golf Club clubhouse on Country Club Road. This must be very near the “Haseman/dye plant” locality mentioned above, with 20-foot or more bluffs and rip-rap along the shore. The sand in this and nearby lots is reddened (see discussion below).

Froede (in press), has recently documented some spectacular, but temporary coastal humatic sandstone (humicrete) exposures between Seagrove Beach and Eastern Lake (a large dune lake) in Walton County. These were exposed by storm surge-related erosion from Hurricane Isaac in 2012. These deposits are located due south of the Choctawhatchee River delta, and about 3.25 miles south of the GIW. It seems very likely they are contiguous with the peat and humate of Beds 1-3 along the GIW. The Seagrove Beach outcrops are now largely covered by nourishment sands.

Figure 4—Native, well-cemented, black humate sandstones, with rip-rap, at Choctaw Beach, along SR-20, Walton County, Florida. Photo: J. Bryan. One should be careful to distinguish coastal
humatic sands and associated peats such as those at Seagrove Beach (Figure 5) from Holocene, back marsh peats that are sometimes exposed on foreshore and backshore zones after substantial beach erosion (Figure 6). Nor should they be confused with exposures of heavy mineral sands (Figure 7).

Figure 5—Temporarily-exposed, coastal humatic sandstone (humicrete) between Seagrove Beach and Eastern Lake, Walton County, Florida. Exposed by storm surge-related erosion from Hurricane Isaac in 2012, but now covered by nourishment sands. Courtesy of Froede (see Froede, in press).

Figure 6—Holocene, back marsh peat exposed on ocean beach by storm erosion. St. Joseph Peninsula, Gulf County, Florida. Photo: J. Bryan.

Figure 7—Winter exposure of heavy mineral sands, Deer Lake State Park, Walton County, Florida. Photo: J. Bryan.

Humate deposition is clearly related to surface water and groundwater flow and the transport of humic acids and related compounds in solution. These soluble humic substances are transported by streams or groundwater until the tea-colored water encounters brackish or saline water, at which time humate is precipitated or flocculated. The humate may be highly variable, from a fine powder to an impervious hardpan. It is suspected that humate-rich sands
and hardpans may underlie the coastal dune lakes located between Destin and Panama City, creating perched water tables. This, along with the impounded effect of the modern coastal dunes, may be the primary controls on dune lake development here (Bryan et al., 2008, p. 118-121). Shallow cores are needed in and around the dune lakes to test this hypothesis. Otvos (2005a) has documented humate sandstone ledges at Belle Fontaine Beach in southeastern Mississippi, where the humatic sandstone act as a local aquiclude, creating hundreds of seeps and springs (“fontaine”) after heavy rains.*

Several radiocarbon dates from humate collected in 2005 from “lower or mid-levels of back-beach dunes” from various localities along Walton County beaches, yield calibrated dates of between 41,000 to 49,000 thousand years (J. Donoghue, pers. com., February 2008), nearly reaching the analytical limits of the C14 method. This would date humate deposition to the middle Wisconsin glacial stage, when sea level was lower and freshwater conditions prevailed over older, Sangamonian interglacial-age beach sands. But if humate is deposited from ground or surface fresh water when in makes contact with brackish or marine waters, then the occurrence of humate deposits must effectively indicate coastal conditions (marine or estuarine), making humate a very useful paleoenvironmental indicator for coastal facies.

The diagenetic fate of humate may also of special geological interest, although it is essentially unstudied. Humate may form not only a brown powder, but in some cases it forms a cement, creating humatic sandstones (see Figure 4). Hardpan layers are also commonly associated with humate, and it has long been observed that impervious, humatic hardpans are associated with certain vegetation types such as poorly-drained flatwoods or dune scrub (Martens, 1928; Kurtz, 1942). Vernon (1942, p. 140) notes the association of hard, brown, sandy clay hardpans with sinkhole and lake bottoms, having formed from “reworked sand combined with carbonaceous material derived from swamp and lake vegetation.” The origin of humatic hardpans, and their potential relation to the hardpans of the Pliocene-aged Citronelle Formation in the region should also be investigated (see Marsh, 1966, p. 76-78; Brown et al., 1994).

The leaching/oxidation of humate could contribute to “dune reddening” and the formation of red beds. Dune reddening is common in Quaternary coastal sands across much of the Florida panhandle (e.g., Royal Bluff, near Carabelle; Topsail Hill and Destin areas; Figure 8), and is thought to result from the chemical weathering of iron-bearing heavy minerals within the sands (Setlow, 1978; see also Gardner & Pye, 1981). Humate, however, has high metal sorption properties, and can be rich in cobalt, copper, iron, manganese, molybdenum, and zinc (Swanson

*It is also plausible that the coastal dune lakes formed by coastal sedimentation, as westward longshore drift, beach ridge accretion, and washover fans progressively divided and filled a late Pleistocene or early Holocene barrier lagoon, eventually isolating the lakes. Compare map, aerial, or satellite images of the narrowing of eastern Santa Rosa Sound near the Santa Rosa-Okaloosa County line (note the abundant cusps or “points”). Destin Harbor would appear to be an eastern remnant of this sound. Similarly, compare the coastline from Panama City Beach to Crooked Island at Tyndall AFB. Grand Lagoon at St. Andrews State Park appears to be nearly a dune lake today.
et al., 1966). Oxidation of humatic iron is also a viable hypothesis for red bed formation (brown, “faded” humatic sands are common along the GIW). In addition, humate is a hypothetical source of kaolinitic clay. According to Swanson and Palacas (1965, p. B24), a humate precipitate sample from Choctawhatchee Bay consisted of about 40% humate and 60% clay, the clay being composed of a poorly crystallized kaolin mineral. The source/origin of the abundant kaolinitic clay within the lower Citronelle Formation (Pliocene) in the western Florida panhandle, for example, has always seemed problematic. Could altered humate result in kaolinitic clay matrix?

Figure 8 – Dune reddening. Near Stallworth Lake, Walton County, Florida. Photo: Hank Johnson, Santa Rosa Beach.

Humatic sands have been documented from inland Pleistocene deposits in nearby Washington County. Vernon (1942, p. 135-7) describes “…light-gray, mottled, argillaceous, coarse sands with scattered quartz pebbles; and fine to medium, white, beach(?) sands interbedded with deep black, carbonaceous, peaty, cross-bedded sandstones…” from exposures about 3-4 miles south of the town of Vernon at elevations of 185 feet above sea level (top of section). Vernon’s Locality W-1 (NW ¼ NW ¼ Sec. 21, T3N, R25W) includes more than 26 feet of “black, cross-bedded, coarse to fine slightly indurated sand, highly impregnated with stumps, roots and plants, both carbonized and uncarbonized” (Vernon, 1942, p. 136). A peat sample from this bed reportedly contains cypress roots, as well as elm, hackberry, pine, and oak pollen. Other humate-bearing exposures were found nearby, and Vernon notes the similarity of these carbonaceous sands with those along Choctawhatchee Bay. All of these appear to be within the Vernon Karst Hills geomorphic province within the Dougherty Karst Plain District (see Rupert & Means, 2009), and their development and exposure could be related to Quaternary lacustrine/wetland environments and karst development. But the age of these deposits is not certain. This area of Washington County is mapped as Citronelle Formation by Scott et al. (2001), Green et al. (2002), and Rupert & Means (2009), but surficial Quaternary sands are not included on many Florida geological maps if their thickness is less than 20 feet (Scott et al., 2001, p. 2).

Humatic sands are commonly associated with heavy mineral deposits, such as those associated with the Trail Ridge complex. Most commercial sand deposits in Florida, in fact, are associated
with organic-rich deposits. The organic-rich sands are thought to be lagoonal facies, and are generally found on one side of a coarse sand deposit, which appears to be a beach/surf zone facies. The Trail Ridge “sap brown” deposits in southern Charlton County, Georgia, form lenses with abundant coarse-grained sand, and is difficult to disaggregate (Marc Hurst, personal communication, May 2013).

Notes on Peats and “Buried Forests” in the Northern Gulf Coast
Humatic sands and peat have been reported across much of the northern Gulf Coast from Apalachicola Bay to Mobile Bay, and are in some cases closely associated with subfossil woods including large logs and tree stumps. Mention of logs or “buried forests” is found scattered in the geological literature, and is also common in newspaper articles and websites. There has been surprising little research on these deposits, but they clearly have much value in understanding Quaternary history of the northern Gulf Coast. They are mentioned here in the hope of stimulating more scientific interest.

In the Apalachicola area, Harper (1910, p. 294, 295) reports on humate and stumps: “On the shores of Apalachicola Bay for several miles west of Apalachicola there crops out beneath a few feet of Pleistocene sand, a dark brown, almost black substance which is worn by the waves into rock-like shapes, and at a little distance looks like rock. But it is only slightly indurated, and a lump of it can easily be pulverized in one’s fingers. The dark color is due to carbonaceous material (and not to iron, as one might suppose at first glance)…Scattered throughout this deposit are the remains of stumps (which should not be confused with the more modern stumps which are common on the same coast, where they have been exposed by the gradual encroachment of the sea upon the land), all of which seems to indicate that this is an ancient swamp deposit of some kind…” Matson and Clapp (1909) also report a well in Apalachicola in that encountered a “pine log” at 60 feet depth.

On the shallow continental shelf about 1.75 miles or more offshore of the Panama City Beach area (30°08′30″N, 85°48′10″W), Shumway et al. (1962) report “a forest of at least 1000 trees” in a water depth of 18 meters (59 feet). The trees trunks stand vertically (i.e., in situ), but are almost completely buried in a “coarse, shelly, relict sand”, with an average diameter of 20 cm at the level sea bottom. The trees are exposed for a linear distance of about 1 km, with an aerial density of about one tree per 9 m². A peat outcrop was also exposed with the trees. One wood sample had a radiocarbon age of 36,500 years B.P. A wood sample from another tree was independently radiocarbon dated at 35,700 years B.P. A peat sample was radiocarbon dated at 40,000 years.

Brooks (1973) reports “a buried forest exposed underwater in the ship channel at Panama City, Florida”, west of Shell Island, with a radiocarbon date of 26,590 ± 1300 years, citing it as evidence of a mid-Wisconsin sea level of within -20 feet from present. This swamp deposit, which contains many pine roots and stumps, is overlain by dune sand that extends 15-20 feet below present sea level. The submerged forests studied by Brooks were also documented by
Lawrence (1974), who examined peat and pine tap roots exposed in the same ship channel at the mouth of St. Andrews Bay in Panama City, and documented additional strata. A lower barrier swamp sequence extends from 50 to 21 feet below MSL, with radiocarbon dates of wood and peat between 28,210 (±2080 - 1650) to 21,290 BP (±790) (mid-Wisconsin). Wood and cones indicate that the trees are *Pinus elliotti* (Slash Pine). This wood and peat is overlain by a resistant, humate-cemented sand, which is overlain by barrier sequence from 21 feet below MSL up to the present dunes. But within the barrier sand, between 10-7 feet below MSL, is another occurrence of pine taproots and peat with radiocarbon ages of 4890 (±100) to 4720 (±110) BP (Holocene). Figure 9 below is from Lawrence (1974), and diagrammatically illustrates the stratigraphy of the Panama City channel between Shell Island and St. Andrews State Park.

![Diagrammatic Illustration](image-url)

**Figure 9**—Diagrammatic illustration of the stratigraphy of the Panama City channel section located between Shell Island and St. Andrews State Park, Bay County, Florida (this is figure 12 of Lawrence, 1974).

About ½ mile north of Milton, Santa Rosa County, about 12 feet of sands, humatic sands, black clays and peat have been reported along the 50-60 yards of the west bank of the Blackwater River. The peat bed is about 3-feet thick and contains subfossil wood of pine(?) and cypress(?) logs and stumps (see Kost, 1887, p. 28; Harper, 1910, p. 295-7; and Leverett, 1931, p. 25,26). These strata are 13-16 feet above MSL, and are of uncertain stratigraphic affinities. Marsh (1966, p. 74ff) also lists various occurrences of fossil and subfossil wood and pollen from the Citronelle Formation, but it seems very likely that Marsh included strata of Miocene, pre-Citronelle Pliocene, and Late Pleistocene in his “Citronelle Formation” (Otvos, 1998). Thus, the stratigraphic affinities of the peat and wood-bearing deposits remain unclear. Marsh (1966, p.
81-82) also mentions the oft-heard oral reports of drillers who commonly encounter buried logs while drilling in areas from Baldwin County, Alabama, through Escambia, Santa Rosa, and Okaloosa counties in Florida.

Southeast of Pensacola, dense, apparently in situ, accumulations of tree stumps and trunks have been dredged from Santa Rosa Sound at Navarre, Santa Rosa County, 6 to 8 feet below the sound surface, during dredging operations for a water pipeline in 1998 (Escobedo, 1998). The reddish brown stumps can reach 5 feet in diameter, and it is suspected they are cypress. Cypress and cedar stumps and peat were documented in the shallow subsurface of the Gulf Breeze peninsula and Santa Rosa Sound area as early as 1827 (Williams, 1927, p. 7; also cited by Smith, 1884, p. 43; and Harper, 1910, p. 294). Davis (1946, p. 189) also mentions a well from Santa Rosa Island with “marine peat from 55-60 feet below layers of Pleistocene sands.”

Lewis et al. (2003) document in situ mummified tree stumps, humus, and peat exposed in the surf zone of the western sector of Santa Rosa Island, Escambia County, Florida. Carbon-14 dates clustered into two groups: <2000 yr. B.P. (Holocene) and 30,000-33,500 yr B.P. (mid-Wisconsin), with one outlier at >45,440 yr B.P. It seems likely that these deposits are equivalent to those in Santa Rosa Sound (previous paragraph), but no correlation has yet been established. Finally, subfossil, in situ cypress trees, exceeding 50,000 years old (beyond the range C-14 dating), have been observed in depths of 60 feet, about 10 miles offshore of Mobile, Alabama (see the website: www.weather.com/news/ancient-underwater-forest-found-alabama-20130317).

It may be worth noting here that fragments of petrified wood are fairly common in the Pliocene Citronelle Formation from Escambia, Santa Rosa, and Okaloosa counties in Florida, and macrofloral remains have been described by Berry (1916) from the Citronelle at Red Bluff on Perdido Bay, Baldwin County, Alabama. Conifer, cypress(?), palm, and some hard woods are commonly encountered in the Miocene Alum Bluff Group in the vicinity of DeFuniak Springs, Walton County, Florida. Large petrified logs have been recovered from the Choctawhatchee River in Alabama (of uncertain age, but perhaps Miocene). And rock hounds have long known of the full-sized, black quartz-bearing, petrified logs found in the Pea River, south of Brundidge and Clio, Pike County, Alabama. These logs appear to be eroding from the Late Paleocene Nanafalia Formation. Many fossil woods of Oligocene, Miocene, and Pleistocene age are known from Mississippi (e.g., the “petrified forest” at Flora, in the Oligocene Forest Hill Sand), and other Gulf Coast localities. These deposits demonstrate that coastal plain sediments are frequently conducive to the preservation of macropaleobotanical remains.

**Future Work**

This guide book is no more than a preliminary field report of the GIW section in Walton and Bay counties, Florida. The exceptional quality and lateral extent of this coastal exposure is rare for the Gulf Coast, and the importance of this section as an archive of Quaternary history of the northern Gulf of Mexico is obvious. Although the GIW section has been exposed for 75 years, I
have found very few specific references to it in the geological literature. So research on this “rediscovered” section is now only just beginning. A partial list of needed research would include a more detailed field description of the stratigraphic section (including lateral variation and correlation), sedimentological analysis (including heavy minerals), description of trace fossils, search for (rare) macroinvertebrate fossils (skeletal and moldic), micropaleontological analysis, paleontological description of the peat bed (including macroflora/wood, palynology, thecamoebae, insect remains—see, for example, Rich, 2008, 1995, 1985; Booth et al., 2003), and radiocarbon dates on the humate, peat, and wood in Bed 4 (buried in dune sands). The 16 meters of GIW section, located as it is at present sea level, should refine our understanding of Late Pleistocene and Holocene sea level change in the Gulf (see Anderson and Fillon, 2004; Anderson and Rodriguez, 2008), terrace formation, and the correlation of the Quaternary section of the northern Gulf of Mexico to that of the Atlantic Coastal section of northeastern Florida and Georgia (see Pirkle et al., 2007, and references therein). And the geochemistry and diagenetic history of humate is a fascinating geochemical problem, with potentially many implications for understanding Neogene strata in the Gulf Coastal Plain. The Gulf Intracoastal Waterway section in Gulf County, Florida, and the Gulf County Canal (at Port St. Joe) should also be re-examined in the context of the West Bay to Choctawhatchee Bay section.

**Water Logged—A Field Guide to Sections**

The GIW is best accessed by boat. Boat ramps are either at the north end of the SR-79 bridge over the GIW in Bay County (north of Panama City Beach), or at Point Washington Community on SR-395, north of US-98, Walton County (northeast of Grayton Beach State Recreation Area). The best and most continuous exposures are along the western half of the canal, primarily in Walton County, and mostly along the northern side of the canal (but good exposures are on each side). The field trip will launch from Point Washington. Various unimproved roads lead to the GIW both from the north and south sides. On U.S. 98, for example, there are unmarked, north-bound dirt roads at 6.2 miles and 8.6 miles east of 331 on 98, but these areas are currently being mined for surface sands and there is much truck traffic on narrow roads. Land access to the GIW from U.S. 98, or on the north side of the canal, is not recommended without permissions. Portions of the waterway were closed or restricted in July and August of 2013, due to excessive rainfall and failure of earthen dams. This has restricted barge traffic, but smaller vessels will have no difficulty. These areas have been temporarily marked with buoys. Although exposure is semi-continuous along the canal, there are several areas of special interest to be examined. These localities are marked below using IW (Intracoastal Waterway) numbers used in field notes by Bryan dating from 2008 to 2013, and located to the nearest second of latitude and longitude using a hand-held GPS unit (sections are easily relocated using longitude coordinates). Additional sections are listed in fine print, listed from east to west, with notes on some distinctive features. Stops that will be visited on this fieldtrip are marked with an asterisk, and are documented in more detail below.
**Exposures Visited on SEGS Field Trip**

Since the exposures along the GIW are semi-continuous, we may stop almost anywhere along the canal. But there are three areas of special interest at which we will visit. These are listed west to east, in the order in which they will be encountered.

**IW-7**

- **Location:** 30° 21′ 18.5″ N, 86° 04′ 25.6″ W
- **Notes:** Good *Ophiomorpha* site; thick, continuous black humate layer; north shore
- **Comments:** Outstanding preservation of abundant *Ophiomorpha* ([Figures 10, 11](#)). *Ophiomorpha* is an ichnogenus for the burrow of a nearshore decapod crustacean, the callianassid shrimp, *Callichirus major* (Say, 1818), or the “Ghost Shrimp”. *PLEASE CONSERVE THIS EXPOSURE FOR STUDY. IF YOU WANT TO SAMPLE THIS BED, PLEASE SAMPLE AS INCONSPICUOUSLY AS POSSIBLE, LEAVING THE BEST-PRESERVED OPHIOMORPHA BURROWS FOR RESEARCH—THANK YOU!*  

![Figure 10 — Ophiomorpha burrows at water level (Bed 1), site IW-7. Photo: J. Bryan.](image1)

![Figure 11 — Close-up of Ophiomorpha burrows at water level (Bed 1), site IW-7. Photo: J. Bryan.](image2)

**IW-8**

- **Location:** 30° 20′ 43.1″ N, 86° 01′ 38.8″ W
- **Visited:** Friday, 7 October 2011, A. McDowell, J. Bryan, NWFSC Historical Geology class
- **Notes:** Measured section (see field guide for full description).
- **Comments:** This section is described in detail above (pages 5-6) in this field book, and see below ([Figure 12](#)).
IW-3
Location: 30° 18' 46.2"N, 85° 59' 55.7"W
Notes: Good, extensive, peat layer exposed at water level w/many logs, N. side of canal.
Comments: The peat layer at water level is dense with well-preserved wood and logs (Figures 13, 14), and continues as a sandy-peat/peaty-sand up-section for perhaps 2 additional meters. The peat-bearing unit appears to be of local occurrence, perhaps representing a wetland or lake deposit, with the finely-stratified, sandier facies above possibly preserving a point bar deposit.
*PLEASE CONSERVE THIS EXPOSURE FOR STUDY. IF YOU WANT TO SAMPLE THIS BED, PLEASE SAMPLE AS INCONSPICUOUSLY AS POSSIBLE, LEAVING THE BEST-PRESERVED EXPOSURES AND LOGS FOR RESEARCH — THANK YOU!*

Figure 12 — Exposure of locality IW-8 (measured section). Photo: J. Bryan.

Figure 13 — Peat bed at site IW-3. Photo: J.Bryan.

Figure 14 — Log in peat bed at site IW-3. Photo: J. Bryan.
Previously-Visited Exposures on the Gulf Intracoastal Waterway

**IW-1**
Location: 30°19′ 27.9″ N, 85°56′ 44″ W  
Notes: Peat at water level, north side of canal

**IW-2**
Location: 30°18′ 42.9″ N, 85°59′ 34″ W  
Notes: Ophiomorpha, humate sands at water level, N. side

**IW-3**
Location: 30°18′ 46.2″ N, 85°59′ 55.7″ W  
Notes: Good, extensive, peat layer exposed at water level with many logs, north side of canal

**IW-4**
Location: 30°19′ 39″ N, 86°00′ 50″ W  
Notes: Gray humate sands; cross-beds

**IW-6**
Location: 30°20′ 34.1″ N, 86°00′ 29.2″ W  
Notes: Good exposure on both sides of canal; thick humate (no burrows); leached; stick-peat horizon high in section, but ~12 ft below the soil at top of section; ~40 ft. of section

**IW-7**
Location: 30°19′ 39″ N, 86°00′ 00″ W  
Notes: Good Ophiomorpha site; thick, continuous black humate layer; north shore

**IW-8**
Location: 30°20′ 43.1″ N, 86°01′ 38.8″ W  
Visited: Friday, 7 October 2011, A. McDowell, J. Bryan and NWFSC Historical Geology class  
Notes: Measured section (see field guide for full description).

**IW-9**
Location: 30°19′ 20″ N, 86°04′ 23.5″ W  
Visited: 26 June 2009, J. Bryan, S. Schindele, J. Donoghue et al. from FSU  
Notes: Very continuous humate with woody peat layer

References Cited


Coastal Dune Lakes
Walton County, Florida

By Sarah Schindele, Choctawhatchee Basin Alliance of Northwest Florida State College

The coastal dune lakes found in Walton County, Florida are globally rare and critically imperiled according to the Florida Natural Areas Inventory (2010) – in other words, they are very special! While varieties of dune lakes occur in coastal areas throughout the world, the coastal dune lakes of Walton County are distinguished by their intermittent connection to the Gulf of Mexico. There are 15 named lakes strung along the coastline of Walton County which are recognized as coastal dune lakes. Most of these form temporary outfalls to the Gulf of Mexico when they reach flood-level. Lake volume increases with contributions from rain and groundwater seepage until the water pressure becomes high enough to push the beach sands out of the way, forming a channel as the lake-water moves out to the Gulf. Depending on water velocity, winds, tides, etc., Gulf water (and attendant biota) enters the channel from the opposite direction as the lake reaches equilibrium. Eventually, sand moves back into the channel, sealing the lake off from the beach once again.
Each lake has individual outfall characteristics, “with outlet openings varying in length, frequency and duration. These openings occur based on each lake’s critical water level, which is driven by climatic conditions (e.g., droughts and rain). As a result, some of the dune lakes can be completely freshwater, some brackish, and some salty, with varying degrees of salinity occurring between different lake stages. The changing condition of water chemistry in the coastal dune lakes makes them dynamic, biologically diverse ecosystems” (Hoyer and Canfield, 2008). Among the environmental and physical factors which contribute to variability in outfall openings are: (1) rainfall and water table (groundwater) elevation, (2) watershed area, lake morphometry (e.g., lake area, mean depth, volume), and hydrology (e.g., water level and flushing rate), (3) outfall sweep distance east and west along the beach, and separation distance between the lake and the Gulf, and (4) tidal elevation and frequency of storm surges (Hoyer and Canfield, 2008).

Water in the coastal dune lakes is generally colored (e.g., tea or black colored) by tannic acids steeped from organic matter in the watershed. It is “slightly acidic, hard water with high mineral content, predominately sodium and chloride” (FNAI, 2010). Nutrient levels are relatively low, in the oligotrophic to mesotrophic range. The lakes are shallow and irregularly shaped, with an average depth between 6 and 8 feet. Their substrate is “primarily composed of sands with organic deposits increasing with water depth” (FNAI, 2010). Given their position
along the coastline, the coastal dune lakes are impacted tremendously by storm activity. They are also unusually sensitive to hydrologic manipulations. “Excessive withdrawals of groundwater could lower local water tables or increase salt water intrusion and, thus, induce successional responses in the lake basin. Groundwater pollution, especially from misapplications of chemicals on the surrounding coastal communities, could significantly alter the nutrient balance and produce devastating effects on the fauna and flora” (FNAI, 2010).

The dune lakes’ vulnerability to catastrophic storm effects has led to their study as part of an emerging science called Paleotempestology; scientists have taken sediment cores from the lakes and examined the sand layers present to determine the historical number of catastrophic storms that have overcome the dunes (Liu and Fearn, 1993, in Hoyer and Canfield, 2008). Various studies have suggested that major events leaving sand layers on the lake bottom have occurred on the order of centuries, though smaller hurricanes occurring on the order of decades do breach the dunes without leaving intact sand layers behind (Hoyer and Canfield, 2008).

Due to the deep color in the lakes’ water, vegetation tends to be limited to shoreline grasses and herbs, “or a dense shrub thicket, depending on fire frequency and/or water fluctuations” (FNAI, 2010). The plant communities typically include rushes (Juncus spp.), sedges (Cyperus spp.), sawgrass (Cladium jamaicense), duck-potato (Sagittaria lancifolia), water lily (Nymphaea odorata), swamp rosemallow (Hibiscus grandiflora), saltbush (Baccharis halimifolia), and wax myrtle (Myrica cerifera). Fish species found in the coastal dune lakes vary from freshwater species like Largemouth bass (Micropterus salmoides) and Sailfin molly (Poecilia latipinna) to saltwater species including Striped mullet (Mugil cephalus) and Red drum (Sciaenops ocellata). The lakes provide important breeding grounds for myriad insects at the base of the food chain (FNAI, 2010). They are also important water resources for all variety of reptiles, amphibians, birds, and mammals, not least of all humans who enjoy fishing, swimming, kayaking, and
paddle-boarding on the lakes. Hiking, photography, and birding are also popular activities around the lakes.

Given the unique physical and biological characterization of the coastal dune lakes, and their situation between the forest and the sea, the lakes are host to a long and diverse list of bird species. Wading birds (e.g., herons, egrets, American Avocets, American Oystercatchers) forage in the shallow marshes and outfalls, and along the shorelines of the lakes and the Gulf of Mexico. Shorebirds, including the endangered Snowy Plover, populate the gaps in the dunes created by the lakes’ outfalls; these protected areas are excellent for nesting, foraging, and rest. Typical shorebirds include Willets, Sanderlings, and terns. Migratory birds (e.g., American coots, Common loons, warblers, woodpeckers) use the lakes as a stopover point and wintering habitat; they take advantage of abundant food sources, ideal habitat and proximity to the migration route. Blackbirds, sparrows, finches, Cardinals, blue jays, and wrens are all found in the grasslands and dunes surrounding the lakes. Bird information was provided by Jeff Talbert, Park Services Specialist at Topsail Hill Preserve State Park.

Photo courtesy of Moon Creek Studios: www.mooncreek.com

Campbell Lake. Photo courtesy of Jeff Talbert Photography: www.facebook.com/JeffTalbertPhotography
The aesthetic and cultural value of Walton County’s coastal dune lakes can hardly be overstated. Florida Scenic Highway 30-A runs along the Gulf coast of Walton County, crossing over and bisecting 11 of the 15 coastal dune lakes as it goes. The lakes anchor the landscape, distinguishing it from that of other Panhandle counties. The tree line bordering the southeastern shore of Western Lake (pictured below) is an area hallmark, instantly recognizable to residents and regular visitors, and common subject matter for many in South Walton County’s thriving artistic community.

Despite their rarity, Walton County’s coastal dune lakes are not widely known. The County has assigned them special recognition as a globally rare and imperiled resource, and has repeatedly sought funding through the state legislature for further study. In terms of regulation, they are not treated any differently from other water bodies by state or federal agencies. Walton County’s land development code delineates a Coastal Dune Lake Protection Zone 300 feet landward of the mean or ordinary high water line of the coastal dune lakes and their tributaries. Restrictions defined within the Protection Zones pertain to: native vegetative communities; septic tanks; storm water management; erosion control; stabilization of the shoreline; hazardous wastes; seawalls, bulkheads, revetments, and rip-rap; endangered species; pollution; open space; and natural outlets.

The Choctawhatchee Basin Alliance and the University of Florida’s Florida LAKEWATCH convened a series of community meetings over the course of several years to produce A Management Plan for Walton County’s Coastal Dune Lakes, written by Hoyer and Canfield in 2008. A TEAM process was employed to identify and prioritize community concerns regarding the management of the coastal dune lakes. All of the science on the lakes to date was presented by Florida LAKEWATCH for stakeholders to review and consider before voting on preferred strategies for addressing each concern. The living document which resulted from this process
was adopted by the County Board of Commissioners, and it continues to drive the search for funding and research on the lakes.

Meanwhile, concerned citizens continue to work toward a special designation for the coastal dune lakes at the state and/or national level. Acclaimed Florida documentary producer/cinematographer/director Elam Stolzfus created a short film about the coastal dune lakes in 2009, and he is currently pursuing support for a full-length feature. The Choctawhatchee Basin Alliance (CBA), the Coastal Dune Lakes Advisory Board (as appointed by the Board of County Commissioners), the South Walton Community Council, and other local organizations persist in their efforts to educate residents and visitors about the unmatched treasure in our midst.

Further resources about the coastal dune lakes are available on CBA’s website: www.basinalliance.org.

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