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GEOLOGY OF WASHINGTON COUNTY, FLORIDA

By

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The Geology of Washington County, Florida

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The following is an overview of the geology of Washington County, Florida. Included are sections on: 1) *geomorphology*, describing the shape and origin of the land surface, 2) *stratigraphy*, describing the underlying rock strata, 3) *ground water*, providing an overview of the aquifer systems in Washington County, and 4) *mineral resources* present in the county.

Geomorphology

The modern land surface of Washington County is a product of prehistoric fluvial and marine deposition during periods when sea level was higher than present. Subsequent erosion by marine currents and waves, as well as later down-cutting by freshwater streams, superimposed both relict marine features, in the form of terraces, and incised stream valleys and ravines on the older sediments. Rainwater runoff, draining into adjacent stream valleys, gradually shaped the highlands into the rolling hills characterizing much of the county today. Additionally, dissolution of the shallow underlying carbonate rock units resulted in the formation of sinkholes, caves and underground drainage. Washington County may be subdivided into a series of geomorphic provinces based on both the elevation and shape of the land surface. Figure 1 is a geomorphic map of Washington County.

Scott and Paul (in preparation) recognize three broad geomorphic districts within Washington County - the Southern Pine Hills District, the Dougherty Karst Plain District, and the Apalachicola Delta District. These three regions are, in turn, comprised of seven smaller geomorphic provinces.

Southern Pine Hills District

The Southern Pine Hills District is a broad, southward-sloping, stream dissected plain extending southward out of Alabama to the Gulf of Mexico shoreline (Scott and Paul, in preparation). It spans the Florida panhandle from the western state boundary eastward to westernmost Washington County. The district is developed on Miocene estuarine sediments, Pliocene Citronelle Formation siliciclastics, and younger marine and fluvial sediments. In Washington County, the district is comprised of the Western Highlands and the Gulf Coastal Lowlands geomorphic provinces.

Western Highlands

The Western Highlands are a series of rolling, stream-dissected hills formed primarily on the Citronelle Formation siliciclastic sediments. They extend a short distance into western Washington County across the Choctawhatchee River valley (Figure 1). The rolling topography of the highlands is the result of stream erosion of an extensive Pliocene river delta thought to have extended over much of the Florida panhandle. The Western Highlands are separated from the Gulf Coastal Lowlands to the south by an indistinct marine scarp. They are bordered on the east by the De Funiak-Bonifay Karst Hills and the Vernon Karst Hills. Elevations of the Western Highlands within Washington County typically range from 25 to 40 feet above mean sea level (MSL).

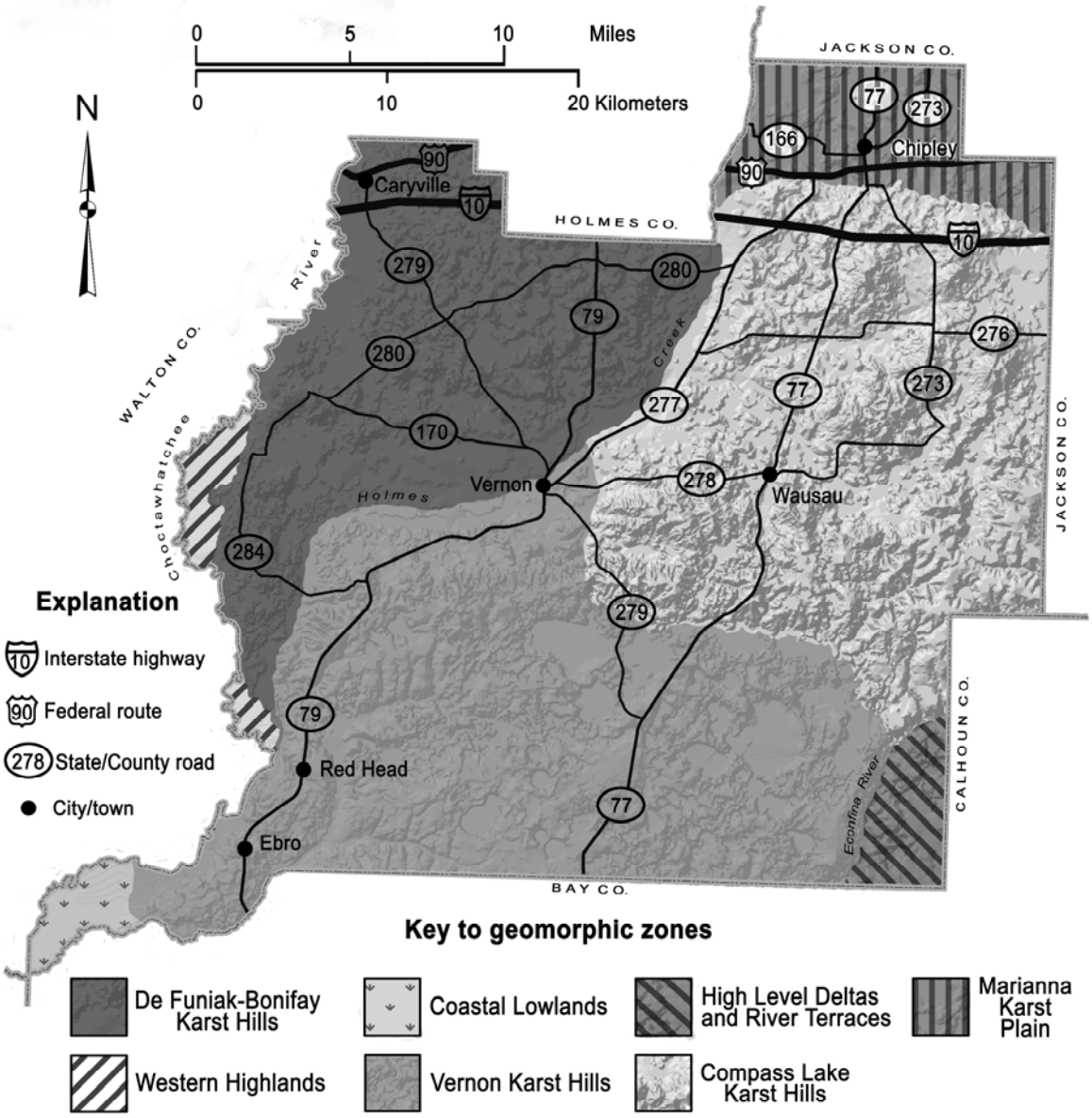

Figure 1. Geomorphic map of Washington County (from Scott and Paul, in preparation).

Gulf Coastal Lowlands

The Gulf Coastal Lowlands fringe the Gulf of Mexico shoreline from the Alabama-Florida state line eastward into Bay County. They form a flat-to-gently-rolling band between the coastline and the Western Highlands to the north. The transition from the elevationally-higher Western Highlands to the lowlands is commonly marked by an indistinct marine escarpment, with a base at approximately 25 feet above MSL. In Washington County, the lowlands occupy the extreme southwestern tip of the county. Elevations within the coastal lowlands in the county range from about 20 to 25 feet above MSL. Undifferentiated Pleistocene and Holocene siliciclastic sediments and alluvium, possibly including reworked Citronelle Formation, underlie the Gulf Coastal Lowlands in Washington County (Scott and Paul, in preparation).

Dougherty Karst Plain District

The Dougherty Karst Plain District occupies a portion of the central Florida panhandle, including most of Washington County. It is comprised of a flat-to-gently-rolling, southwestward sloping plain generally characterized by karst terrain. Karst terrain in Florida is underlain by soluble limestone and dolostone, and commonly contains solution landforms such as sinkholes, closed depressions, subterranean drainage and caves dissolved in the bedrock by slightly-acidic groundwater.

A local structural feature named the Chattahoochee "anticline" forms a structurally stable high in the subsurface to the northeast of Washington County. Soluble Eocene to Miocene carbonates occur near or at the surface over this feature, and dip away to the southwest off its flank. As a result, this feature has been a significant influence in the development of karst landscape in Washington County.

The four geomorphic provinces of this district are all present in Washington County: the De Funiak Springs-Bonifay Karst Hills, the Marianna Karst Plain, the Compass Lake Karst Hills, and the Vernon Karst Hills. All have been shaped by dissolution of the underlying carbonate bedrock and erosion by surface streams. Each is designated based primarily on differing characteristics of the karstic landscape.

De Funiak Springs-Bonifay Karst Hills

The De Funiak Springs-Bonifay Karst Hills province occupies the northwestern portion of Washington County. The landscape is comprised of hilly terrain similar to that of the Southern Pine Hills, but it contains sinkholes and other solution features that generally increase in number eastward in the province. Miocene and Pliocene siliciclastic sediments overlie soluble carbonate bedrock throughout the karst hills. Elevations range from about 25 feet above MSL at the southernmost end of the province to nearly 150 feet above MSL on the higher hilltops in the northern portion of the province. The southern and eastern boundaries of the province are delineated by the valley of Holmes Creek.

Marianna Karst Plain

The Marianna Karst Plain occurs in northeastern-most Washington County, from where it extends northward into adjacent Jackson County. The land surface is gently rolling to relatively flat with numerous shallow sinkholes and caves. The province reflects the shoaling of soluble carbonate rocks over the southern flank of the Chattahoochee anticline. It has been heavily influenced by fluvial erosion and dissolution in the underlying carbonate bedrock. Elevations in the Marianna Karst Plain in Washington County typically range between about 60 feet above MSL in the western and northern portion to nearly 170 feet above MSL on the higher hilltops in the eastern portion. Eocene, Oligocene and Miocene carbonates occur at or near the surface throughout the Marianna Karst Plain. The province is bounded on the south by the Compass Lake Karst Hills.

Compass Lake Karst Hills

The Compass Lake Karst Hills occupy east-central Washington County, south of the Marianna Karst Plain. They comprise an area of rolling hills underlain by shallow carbonates mantled with siliciclastic Alum Bluff and Citronelle Formation sediments. The karst hills contain some the highest elevations in Washington County. Land surface elevations range from about 50 feet above MSL near Holmes Creek on the west to almost 300 feet above MSL near the eastern county line. The higher hill tops may, in part, reflect the pre-erosional elevation of the delta plain thought to have covered the area in the Pliocene. Karst features are present throughout the province, but are less common in the western portion of the karst hills and become more common to the east and north toward the Marianna Karst Plain.

Vernon Karst Hills

The Vernon Karst Hills province occupies a broad area of central and southern Washington County. The region is characterized by rolling hills, commonly pocked with small sinkholes, interspersed flat, plain-like karst valleys, and a series of larger, well-defined sinkhole lakes in the southern portion. Elevations in this province range from about 20 feet above MSL in the southwestern part of the zone to about 200 feet above MSL on the higher hills south of the town of Vernon.

Among the most notable features of the Vernon Karst Hills are the large sinkholes dotting the landscape in the southern part of the province, some of which contain large lakes. Several of the individual sinkhole lakes are nearly one-half mile in diameter. Some of the larger lakes formed by coalesced sinks reach a mile and a half in their longest dimension. The sinkholes present in the Vernon Karst Hills are also significantly deeper and steeper-sided than other parts of the county (Scott and Paul, in preparation). The underlying carbonate bedrock is covered by Alum Bluff Group siliciclastics and Citronelle Formation sediments, which commonly cap the hills in the region.

Apalachicola Delta District

The Apalachicola Delta District comprises just the southeastern-most corner of Washington County (Scott and Paul, in preparation). The Econfina River forms the boundary between this district and the adjacent Vernon and Compass Lake Karst Hills provinces on the west and northwest. In its full extent the district extends from central Bay and southeastern Washington Counties eastward to the western one-third of Wakulla County. The southern terminus of the delta district includes the barrier island complex developed along the Gulf coast. Within Washington County the district has one province, the High Level Deltas and River Terraces.

High Level Deltas and River Terraces

In Washington County this province is generally characterized by well-drained, gently-rolling topography. Deltaic Citronelle Formation sediments form the local hills. Elevations range from about 40 feet above MSL near the Econfina River, in the southern portion of the zone, up to about 155 feet above MSL on the higher hills along the eastern Washington-Bay County line.

Marine Terraces

An integral part of the present-day geomorphology of Washington County is a series of relict marine terraces. These terraces are step-like surfaces of erosion and deposition representing prehistoric sea bottoms developed by advances and retreats of the sea since the Miocene Epoch. In many areas of Florida they have been extensively modified by karst dissolution in the underlying carbonate bedrock as well as fluvial erosion. Healy (1975) recognizes six marine terraces based on elevation in Washington County. In order of descending elevation (and age), these shorelines are the Hazelhurst, the Coharie, the Sunderland-Okefenokee, the Wicomico, the Penholoway, and the Pamlico Terraces.

The Hazelhurst Terrace (Cooke, 1939) comprises the higher hilltops in the eastern and northeastern parts of the county. Lower limits of the Hazelhurst occur at approximately 220 feet above MSL; the upper limits in Washington County occur at approximately 300 feet above MSL elevation. The Coharie Terrace comprises the land surface areas delineated by the 170 to 220 feet above MSL contour lines. In Washington County, this terrace occurs in small areas of the northeastern, east-central, and southeastern parts of the county. As used in this report, the Sunderland Terrace lies between 100 and 170 feet MSL; it occupies extensive areas of northwestern, eastern and southern sections of Washington County. The Wicomico Terrace occurs in narrow band bordering the northern and southern portions of the Holmes Creek valley and its major tributaries. Similarly, the Penholoway Terrace occurs in bands corresponding to the 42 to 70 feet above MSL elevations in the Holmes Creek and Choctawhatchee River valleys. The youngest terrace, the Pamlico, lies at elevations of approximately 8-25 feet above MSL; it occupies most of the southern part of the Choctawhatchee River valley (Healy, 1975).

Stratigraphy

Washington County is underlain by a thick sequence of marine carbonates and siliciclastics. The oldest rocks in the county were penetrated by an exploratory oil well drilled to over 14,000 feet deep. These rocks typically consist of Upper Triassic (230-200 million years old) red, purple and gray sandstones, siltstones and shales (Applegate et al., 1978).

The oldest rocks that occur at or near the land surface in Washington County belong to the Ocala Limestone of Upper Eocene age. These rocks are marine in origin and occur in the northwestern corner of the county along the Choctawhatchee River. The youngest rocks in the county are Holocene in age and consist of recently deposited sands and clays that occur primarily in river floodplains. Most fresh water and mineral resources in Washington County occur within Eocene Epoch and younger rocks and the following discussion of the stratigraphy is limited to the these units. Figure 2 is a geologic map of the county and shows the distribution of mapped geologic units within twenty feet of the surface. Figures 3 and 4 are geologic cross sections through the county.

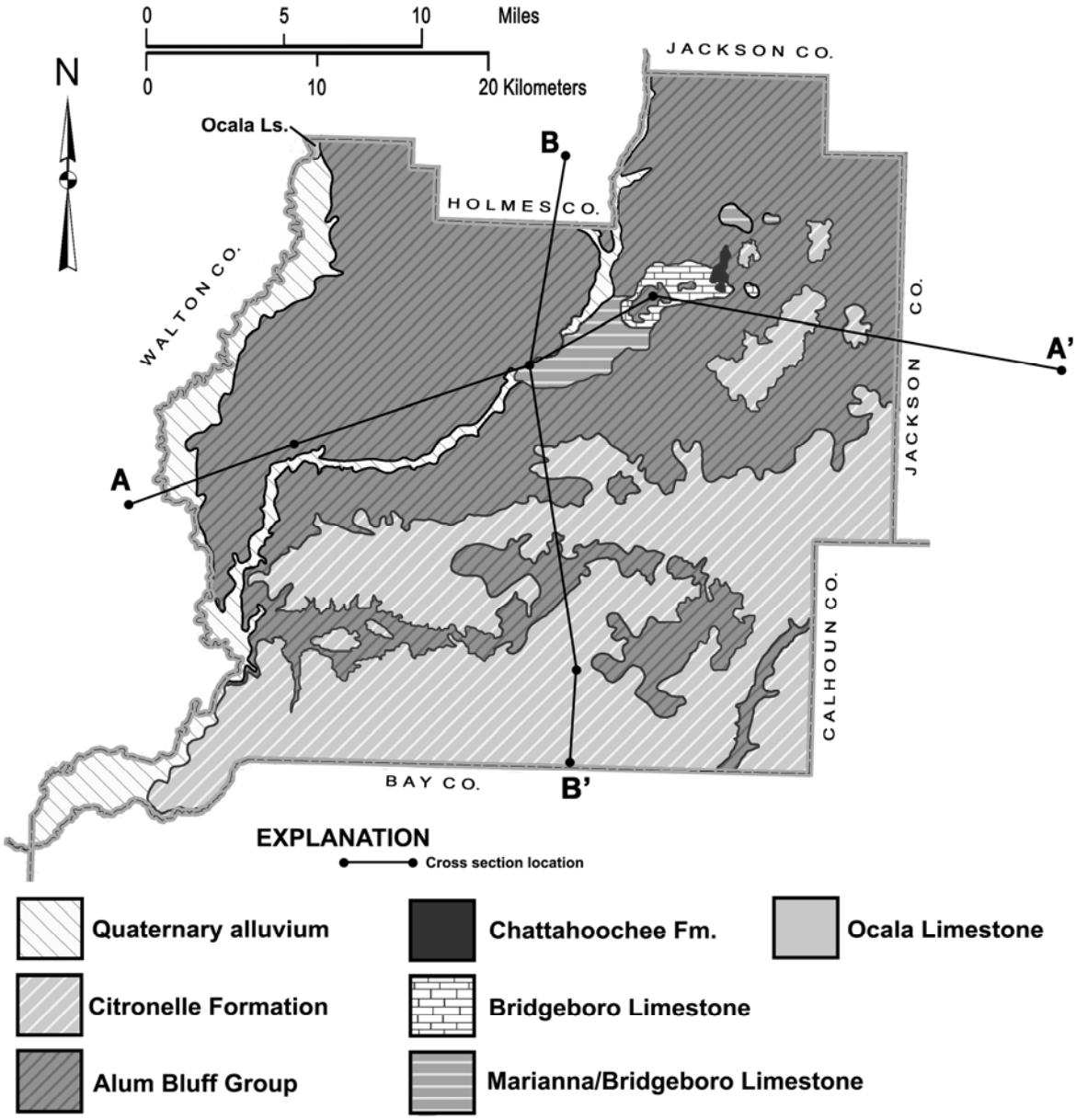

Figure 2. Geologic map of Washington County (modified from Green et al., 2002 and Scott et al., 2001).

Eocene Series

Ocala Limestone

The Ocala Limestone (Dall and Harris, 1892) underlies the entire county. It consists of a cream-to-white color, poorly-to-moderately indurated limestone. Occasionally this formation can be dolomitized, but it is primarily limestone comprised of marine fossils that include foraminifera, mollusks and echinoids. Weathered portions of the unit may be

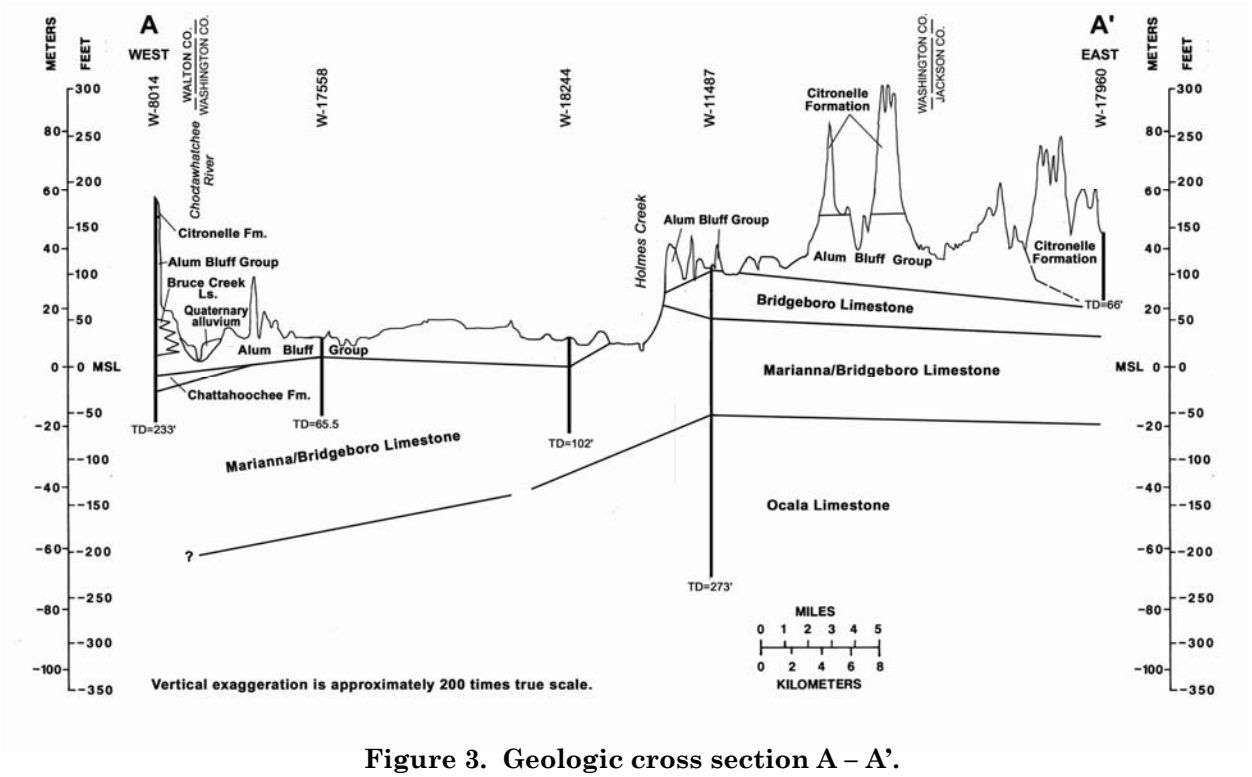

Figure 3. Geologic cross section A – A'.

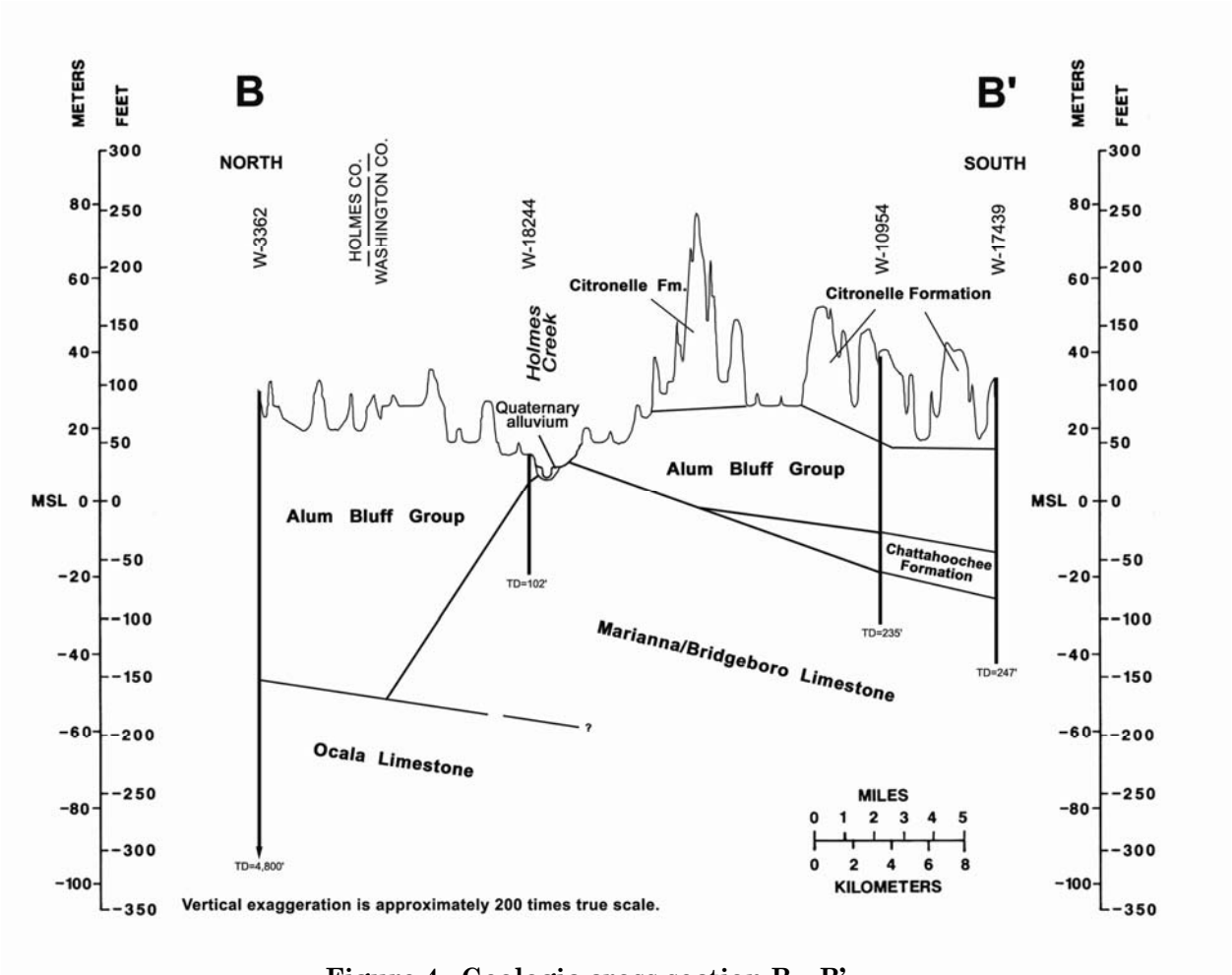

Figure 4. Geologic cross section B – B'.

silicified. The formation gently dips to the southwest and occurs at or near the surface in the northwest (Green et al, 2002) and possibly the northeast (Vernon, 1942) corner of the county. The Ocala Limestone ranges from 200 feet thick in the northwestern part of the county to 400 feet thick in the southwestern portion of the county (Miller, 1986). The Ocala Limestone is unconformably overlain by the Marianna Limestone or undifferentiated Bridgeboro/Marianna Limestones in the central and southern portions of Washington County, and is unconformably overlain by Alum Bluff Group sediments in the northern-most portion of the county. The Ocala Limestone is considered to be part of the Floridan aquifer system in Washington County.

Oligocene Series

Bridgeboro Limestone, Marianna Limestone, and Suwannee Limestone

The Oligocene Series sediments that occur in Washington County are difficult to distinguish on a strict lithologic basis. These deposits unconformably overlie the Ocala Limestone in the county. They consist of marine limestones and dolostones with differing fossil assemblages.

The Marianna Limestone (Matson and Clapp, 1909) occurs at or near the surface in the northeastern portion of Washington County. Green et al. (2002) cite a good exposure of the unit at the Trawick Quarry southwest of Chipley. The Marianna Limestone ranges incolor from white to cream to light gray. It is a soft, chalky, fine grained, poorly indurated limestone, typically containing abundant foraminifera. In the subsurface, the Marianna Limestone is commonly dolomitized and devoid of fossils.

The Bridgeboro Limestone (Huddlestun, 1981; Manker and Carter, 1987) is typically a white to yellow, fossiliferous, marine limestone. It contains diagnostic fossils including red algae and rhodoliths, which are rounded clasts created by wave action and algae. Green et al. (2002) mapped Bridgeboro Limestone in the northeast portion of the county and indicate that this unit conformably overlies the Marianna Limestone in several cores and quarries. A good exposure of Bridgeboro Limestone may be seen in the Trawick Quarry (Green et al., 2002). The thickness of the Bridgeboro can reach up to 31 feet.

The use of the name Suwannee Limestone (Cooke and Mansfield, 1936) to describe Oligocene sediments in Washington County is problematic. The Suwannee Limestone was originally identified in this region of the Florida panhandle by utilizing mollusk fossils (Mansfield, 1938, 1940; Cooke, 1939). Vernon (1942) suggested that this correlation may be questionable because of the poor preservation of these fossils, and he defined the Suwannee Limestone in Holmes and Washington Counties, as "all limestone beds lying below the Tampa (Chattahoochee Formation) and above definite Marianna Limestone". The stratigraphic unit which Cooke, Mansfield and Vernon referred to as the Suwannee Limestone has been mapped by previous investigators under many different names (Reves, 1961). After extensive field work and further analyses of cores and cuttings, Green et al. (2002) concluded the unit mapped as Suwannee Limestone by previous authors is likely either Bridgeboro Limestone or undifferentiated Marianna/Bridgeboro Limestone. The latter convention is used in the cross sections.

The entire Oligocene section is variable in thickness across the county. Green et al. (2002) place the top of the Marianna/Bridgeboro Limestone in a range from approximately 75 feet above MSL to 30 feet below MSL, with the unit attaining a maximum thickness of 250 feet in a well in the southeastern part of the county; these authors place the top of the Bridgeboro Limestone between 125 feet and 95 feet above MSL in northeastern Washington County, where the unit reaches a maximum observed thickness of 31 feet. The Oligocene sediments comprise part of the Floridan aquifer system in the region.

Miocene Series

Chattahoochee Formation, Bruce Creek Limestone and Alum Bluff Group, undifferentiated

The Miocene series sediments unconformably overlie the Oligocene Series sediments in Washington County. These sediments consist of the Lower Miocene Chattahoochee Formation, the Middle Miocene Bruce Creek Limestone, and the Middle Miocene to Pliocene Alum Bluff Group.

The Chattahoochee Formation (Langdon, 1899) is composed of a predominately brownish-gray, moderately indurated, sandy limestone in southern and eastern Washington County (Green et al., 2002). In the subsurface, Green et al. (2002) noted the top of the Chattahoochee Formation in wells at elevations ranging from 160 feet above MSL in the northeastern part of the county to approximately mean sea level in southeastern Washington County. It attains a maximum observed thickness of 50 feet.

The Bruce Creek Limestone (Huddlestun, 1976) is a white to light yellow-gray, moderately indurated marine limestone. In Washington County it is a subsurface unit, and extends into the western and southern portions of the county from adjacent Walton County. Green et al. (2002) observed a 26-foot thick section of Bruce Creek Limestone at a depth of 48 feet above MSL it in one well in the southwestern part of the county. Schmidt (1984) shows it in the subsurface of southern Washington County at depths between about 80 feet above MSL and 125 feet below MSL, pinching out in the south-central part of the county.

Sediments of the Miocene Alum Bluff Group (Huddlestun, 1984; Braunstein et al., 1988) unconformably overlie the older Oligocene and Eocene units in most of the county, and the Chattahoochee Formation, where it is present. Lithologically, Alum Bluff Group sediments range from clayey sands and gravels, to greenish, stiff, micaceous clays with variable admixtures of silt, sand, and shell. In river and stream valleys it commonly occurs as a greenish, clay to clayey sand with occasional shell beds. The Alum Bluff Group occurs throughout most of Washington County and can generally be seen in outcrop at topographic elevations below 150 feet MSL. Green et al. (2002) found that the unit attains a maximum thickness of 180 feet in wells.

Pliocene Series

Citronelle Formation

The name Citronelle Formation was applied by Matson (1916) to sediments exposed near Citronelle, Alabama. The general lithology of the Citronelle Formation in Washington County is orange to red, clayey, medium to coarse-grained quartz sands and clayey sands with

occasional clay lenses and beds of friable quartz pebbles. Cross-bedding is present in many exposures. The original thickness of the formation is uncertain, as erosion has removed the upper portion over much of the county. Green et al. (2002) noted its thickness as over 110 feet in the northern part of the county. Many of the higher hills in Washington County are capped with Citronelle Formation and these may approximate the pre-erosion elevation of the extensive delta plain in which the unit was originally deposited.

Sediments of the Citronelle Formation blanket most of the southern portion of Washington County (Figure 2), and occur on numerous hilltops throughout the county. It lies unconformably upon sediments of the Alum Bluff Group. Local deposits of Quaternary alluvium may overly the Citronelle Formation in stream valleys.

Pleistocene – Holocene Series

Washington County is blanketed with variably-thick soil horizons and fluvial deposits, generally considered to be Pleistocene to Holocene in age. The larger stream valleys within the county commonly contain deposits of Pleistocene and Holocene alluvium. Most of these sediments are derived from erosion of Citronelle Formation and older units within the county as well as possible upstream sources in adjacent counties and Alabama. These undifferentiated deposits are typically sands and clays and gravels. Occasional traces of carbonized wood and carbonaceous horizons of peat and humate occur (Green et al. (2002). Some may be reddish in color due to the iron-rich nature of the Citronelle Formation from which they were eroded.

Ground Water

Ground water is water that fills the pores and interstitial spaces in the rocks and sediments beneath the surface of the earth. Most of Washington County's ground water is derived from precipitation within the county, in neighboring Florida counties, and in southern Alabama. A portion of the precipitation leaves the area by surface runoff in stream flow or by evapotranspiration. The remainder soaks into the ground and some moves downward into the porous zone of saturation. The top of the zone of saturation is known as the water table. Once in the zone of saturation, the water moves under the influence of gravity towards discharge points such as wells, seeps, springs, or eventually the Gulf of Mexico. Some of the water seeps into the deeper aquifer units, providing recharge to them.

In Washington County, three primary ground-water units are present. These are the Floridan aquifer system, the intermediate aquifer system or intermediate confining unit, and the surficial aquifer system, (Copeland et al., in preparation).

Floridan aquifer system

The name Floridan Aquifer was originally proposed by Parker, et al. (1955) for the artesian aquifer including all or parts of the Middle Eocene to Middle Miocene geological formations. The unit name was modified to Floridan aquifer system (FAS) by the Southeastern Geological Society Ad Hoc Committee (1986).

In Washington County, the Eocene Ocala Limestone, the Oligocene Mariana and Bridgeboro Limestones, the Miocene Chattahoochee Formation, and where it is present, the

Bruce Creek Limestone, comprise the upper portion of the FAS. Most freshwater supply wells in the county draw from the upper FAS limestones at depths ranging from 50 to 300 feet below land surface. The thickness of the FAS ranges from about 100 feet in north-central Washington County to about 700 feet in the southwestern part of the county (Scott et al., 1991).

Intermediate aquifer system or intermediate confining unit

The intermediate aquifer system or intermediate confining unit (IAS) is a system of low-permeability clays and interbedded carbonates forming both confining units to the underlying carbonates of the Floridan aquifer system and localized aquifers. In most of Washington County the IAS is locally contained within the Miocene portion of the undifferentiated Alum Bluff Group. In the north-central part of the county, principally near the Marianna Karst Plain, Oligocene residuum may form a confining unit to the underlying Florida aquifer system (Scott et al., 1991). The IAS varies between about 50 feet and 100 feet thick in Washington County (Scott et al., 1991).

Surficial aquifer system

Water in the shallow, Pliocene portion of undifferentiated Alum Bluff Group and Citronelle Formations is generally not confined and the water level is free to rise and fall. This unconfined water comprises the surficial aquifer system (SAS). The SAS reaches a maximum thickness of about 100 feet in north-central and southeastern Washington County (Scott et al., 1991). Owing to the shallow availability of freshwater from the Floridan aquifer system, the SAS is not used extensively in the county as a potable water source.

Springs

Springs are points where underground water emerges onto the earth's surface (Copeland, 2003). Scott et al. (2004) recognize thirty five named springs and numerous unnamed springs in Washington County. Most are located along Holmes Creek and the Econfina River. These include one first magnitude spring (flow greater than 100 cubic feet per second), Jack Paul Spring, located along Holmes Creek near the southwest corner of the town of Vernon. Second magnitude springs (flow between 10 and 100 cubic feet per second) include Cypress and Beckton Springs, situated north of Vernon along Holmes Creek, Washington Blue Spring Choctawhatchee, located north of Ebro near the Choctawhatchee River; and Williford and Washington Blue Econfina Springs, situated in southeastern Washington County along the Econfina River (Scott et al., 2004). Most of the larger springs discharge freshwater from the Floridan aquifer system, and are used for recreation.

Mineral Resources

Historically, several mineral commodities have been mined in Washington County for both commercial and public uses. The following discussion provides a general overview of the near-surface mineral commodities and petroleum resource potential for Washington County.

Clay

Clay occurs as a major constituent of the Chattahoochee Formation, Alum Bluff Group and Citronelle Formation in Washington County. For the most part, the clays in these units are intermixed with varying proportions of carbonates, quartz sand and gravel or occur as very thin discontinuous beds. Although these formations occur over much of Washington County, the impure, thinly-bedded nature of the contained clays generally precludes extensive utilization for fired products. However, during the 1920s-1940s the Hall Brick company produced brick from a localized floodplain clay deposit located two miles southwest of Chipley (Bell, 1924). The brick was utilized for local construction. Vernon (1942) notes the presence of two, nearly pure kaolin clay deposits in the county, but judged them non-commercial because of overburden thickness. No other commercial clay operations have been viable in the county. Clayey sands, sometimes categorized as clay, are commonly mined for use as fill but would not be suitable for fired products. Future uses of clay in Washington County will depend largely on the discovery of suitable deposits as well as local market demand.

Limestone and Dolostone

Limestone ($CaCO_3$) and dolostone ($CaMg(CO_3)_2$) belonging to the Oligocene Marianna and Bridgeboro Limestones and Miocene Chattahoochee Formation occur near the surface in northern Washington County. Reves (1961) and Yon and Hendry (1969) document a number of areas of commercial potential in the county.

Limestone is commonly used for construction materials, particularly as a roadbase material and in the production of concrete and mortar. At least one small private pit southwest of Chipley produced limestone construction block for local use in the 1920s (Mossom, 1925). In recent years limestone has been mined at two locations in Washington County: Choctawhatchee Rock Company operated a mine in northwestern corner of the county near Hinson's Crossroads; and White Construction has intermittently operated the Trawick mine, southwest of Chipley. Future exploitation of this resource will be dependent upon market demand.

Sand and Gravel

Quartz sand and gravel (SiO_2) occur in abundance over most of Washington County. It is a principal component of the Pleistocene-Holocene alluvial deposits and the Pliocene Citronelle Formation. Much of this material occurs interbedded and consolidated with clays and silts, and washing is required to extract the sand. In some cases, especially when the material is to be used as fill dirt, the clay content is not significant. The primary commercial uses for this sand are road construction, fill, and asphalt additive.

During the 1920s, sand deposits southeast of Chipley were utilized for local plastering, concrete, bricklaying and road surfacing; similar deposits containing gravel were also dug near Vernon for use as concrete aggregate (Martens, 1928). In later years several commercial companies and the county government have extracted sands from various areas in Washington County for use in local projects (Spencer, 1989; FDEP Bureau of Mine Reclamation in-house database). The abundance of sand and gravel within Washington County makes impure construction and fill grade sand-mining potential relatively high. Due to the lack of demand, however, development of this industry on a large-scale basis remains unlikely.

Petroleum

The recent production of oil in Florida occurred from Mesozoic age sediments in two major areas of Florida. In south Florida, a number of fields are situated along the Sunniland Trend, and produced from the Lower Cretaceous Sunniland Formation; in northwestern Florida, a series of fields in northern Santa Rosa County produced oil from the Jurassic Smackover and Norphlet Formations (Applegate and Lloyd, 1985).

Various companies have drilled a total of 14 oil test wells in Washington County, ranging in depth from 4,170 feet to 14,044 feet below land surface. None of the wells encountered producible oil or gas, and all were plugged and abandoned as dry holes. The position of Washington County updip of the productive portions of the Smackover and Norphlet Formation pinchouts likely precludes a high petroleum potential for the area (Applegate et al., 1978).

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