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Geology of Polk County, Florida
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Florida Geological Survey
Tallahassee, Florida
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PHYSIOGRAPHY

Although, several authors have discussed the physiography of the Florida peninsula, for the purposes of this report, White's (1970) classification will be utilized. Polk County lies within the Central Highlands physiographic province. The vast majority of the county lies within the Polk and Lake uplands. Several ridges rise above the Polk Upland surface. The most prominent ridge is the Lake Wales Ridge which forms the eastern boundary of the Polk Upland (White, 1970). That portion of the county lying east of the Lake Wales Ridge is part of the Osceola Plain. A small portion of north-western Polk County lies within the southern end of the Western Valley (White, 1970).

Elevations within the county range from 50 to 305 feet above Mean Sea Level (MSL). The lowest elevations are found along the eastern county boundary (Kissimmee River Valley). The highest elevations are found along the crest of the Lake Wales Ridge in the vicinity of Lake Wales and Babson Park (Stewart, 1966).

Polk and Lake Uplands

The majority of Polk County lies within the Polk and Lake uplands. Elevations within the Polk Upland range generally between 100 and 130 feet above MSL (White, 1970). In the northern portion of the county the Polk Upland merges with the Lake Upland. There is not a distinct topographic distinction between the two uplands, therefore the dividing line is drawn

arbitrarily (White, 1970).

The Polk Upland is bounded by the Gulf Coastal Lowlands and the Western Valley on the west and north, by the DeSoto Plain on the south and by the higher ground of the Lake Wales Ridge on the east. The Lakeland, Winter Haven and Lake Henry ridges rise from the surface of the upland. White (1970) states that these ridges appear to be remnants of a previous widespread upland. With the exception of the ridges, the surface elevations of the Polk Upland range from 100 to 130 feet above MSL (White, 1970).

Lake Wales Ridge

The Lake Wales Ridge is the most prominent topographic feature in peninsular Florida. The ridge is the distal remnant of a much longer ridge which may have, at one time, included the Trail Ridge in northeastern Florida. Elevations of the ridge crest range from 150 to 305 feet above MSL, and are highest at Lake Wales and Babson Park (Stewart, 1966).

The ridge is a highland composed primarily of coarse clastic material which has been dissected by streams and karst activity and "straightened on its flanks by coastal erosion to produce its present western bounding scarp and a probable buried former eastern bounding scarp" (White, 1970). The preservation of the Lake Wales Ridge as a present day highland is thought to be due to the presence of the clayey, gravelly, coarse quartz sand which has limited, but not completely prevented, dissolution of the underlying limestone.

Osceola Plain

That portion of Polk County east of the Lake Wales Ridge lies within the western portion of the Osceola Plain. The Osceola Plain is bounded on the west by the Lake Wales Ridge and to the east by lower lying marine

scarps. Thus it is properly a marine terrace (White, 1970). Local relief is generally small, elevations of the plain typically lie between 60 and 70 feet above MSL (White, 1970), although it is somewhat lower along the Kissimmee River chain. In the southeastern corner of the county, the Bombing Range Ridge rises above the level of the plain. The Bombing Range Ridge is 21 miles long and 3-4 miles wide and reaches elevations of 125 to 145 feet above MSL. White (1970) states that it has all the attributes of a large marine sand bar.

Western Valley

A small portion of northeastern Polk County lies on the eastern flank of the southern part of the Western Valley. The Western Valley is a low irregular valley produced by differential reduction of unprotected soluble material adjacent to the Brooksville Ridge and Polk Upland. That portion of Polk County which lies within the Western Valley has elevations which range from 75-100 feet above MSL.

LITHO-STRATIGRAPHY

Surface and near surface sediments in Polk County consist of quartz sand, clay, phosphorite, limestone and dolomite. These sediments range in age from Late Eocene to Holocene (40 million years ago to present).

Eocene Series

The Eocene Series in Polk County consists of the Oldsmar, Avon Park and Ocala Group limestones. Only the uppermost unit, the Ocala Group of Late Eocene age, will be discussed here.

Ocala Group

The Ocala Group consists three formations, which in ascending order

are, the Inglis, Williston and Crystal River formations. Essentially all of Polk County is underlain by limestone of the Ocala Group.

Inglis Formation

In Polk County, the Inglis consists of white to cream to dark brown, granular, fossiliferous, well indurated limestone and dolomite (Stewart, 1966). The Inglis ranges from approximately 35 feet thick in the northwestern portion of the county, to as much as 95 feet thick in southeastern Polk County (Stewart, 1966). The Inglis is the uppermost limestone present in extreme northeastern Polk County (vicinity of Haines City) due to erosion of overlying units (Stewart, 1966).

Williston Formation

The Williston is a white to cream or brown limestone consisting of a coquina of foraminifera set in a pasty calcilutite matrix. The formation is generally poorly indurated and may be dolomitized (Stewart, 1966). The formation is missing in extreme northeastern Polk County, but underlies the remainder of the county with thicknesses which range from 10-90 feet (Stewart, 1966).

Crystal River Formation

The Crystal River is a white, cream, gray, or tan very pure limestone. The formation is generally poorly indurated and consists of a coquina of large foraminifera in a chalky calcilutite matrix (Stewart, 1966). The Crystal River is at or near the ground surface over a large area of northern Polk County. Thicknesses in this area range from 30-60 feet and thicken southward to approximately 150 feet (Stewart, 1966). The formation is silicified throughout much of the surface exposure area of northern

Polk County (Stewart, 1966).

Oligocene Series

Suwannee Limestone

The Suwannee Limestone is present throughout the western portion of Polk County, but is missing in the north and eastern portion of the county due to erosion on the flanks of the Ocala Uplift (NW-SE trend). The Suwannee Limestone, in Polk County is white, cream or tan, variably textured (calcarenite to calcilutite), fossiliferous, poorly to well indurated and variably recrystallized. The formation locally contains dolomitized or silicified zones (Stewart, 1966). Common fossils include benthic foraminifera, bryozoans, molluscs and echinoids.

The top of the Suwannee is found at 70-80 feet above MSL in the area north of Lakeland and west of Polk City and dips gently to the south and south-southwest. Along the western half of the southern county boundary the Suwannee is found at approximately 250-300 feet below MSL (Wilson, 1977).

The thinnest portion of the Suwannee is along the eastern edge of the formation's extent along the trend of the Ocala Uplift, where the formation thins to zero. The thickest portion ranges from 100-150 feet in that portion of western Polk County south of Lakeland and Bartow (MacGill, 1976, unpublished Bureau of Geology map).

Miocene Series

Hawthorn Group

Scott (1986) has raised the Hawthorn from formation status to group status. The Hawthorn Group will include those sediments which in the past have been included in the Tampa, Hawthorn and Bone Valley formations. In

1986). The Tampa Member is a white to tan-colored, quartz sandy limestone with a carbonate mud matrix. Varying amounts of clay are usually disseminated throughout the rock (King and Wright, 1979; Scott, 1986). Some beds within the Tampa Member contain more than 50 percent quartz sand. Dolomite is relatively uncommon within the Tampa Member (King and Wright, 1979; Scott, 1986).

The Tampa Member is present only in the southwestern corner of Polk County, becoming indistinct due to a facies change at its eastern extent. The top of the Tampa is encountered at elevations which range from slightly greater than 50 feet above MSL to approximately 150 feet below MSL in the extreme southwestern corner of Polk County (Scott, 1986). The thickness of the member in Polk County is less than 50 feet (Scott, 1986).

The upper (unnamed) member of the Arcadia Formation includes those sediments which in the past have been referred to as the "Hawthorn carbonate unit" (Scott, 1986). Lithologically, these sediments consist of white to yellowish gray, quartz sandy, phosphatic and sometimes clayey, dolomites and limestones (uncommon). Occasional beds of carbonate rich quartz sand and thin clay beds are present.

The upper member of the Arcadia is present throughout Polk County with the exception of the northernmost portion of the county. In those areas where the Tampa and Nocatee Members are not recognized, the entire formation remains undifferentiated. The top of the formation ranges from 112 feet above MSL in the vicinity of Lakeland, to approximately 125 feet below MSL in the southeastern corner of the county (Scott, 1986). The thickness of the Arcadia ranges from zero at its northern extent, to approximately 300 feet in the southwest corner of the county. In general the formation dips to the south and southeast (Scott, 1986).

Polk County, the Hawthorn Group consists of, in ascending order, the Arcadia Formation and the Peace River Formation.

Arcadia Formation

The Arcadia Formation contains, in ascending order, the Nocatee and Tampa members and an unnamed member. The Nocatee Member is composed of the sediments which were previously described as the "sand and clay unit" of the Tampa Limestone (Wilson, 1977). The Tampa Member includes the sediments of the type Tampa Formation of King and Wright (1979). The unnamed (upper) member includes those sediments which in the past have been referred to as the "Hawthorn carbonate unit" (Scott, 1986).

The Nocatee Member consists of a complexly interbedded sequence of variably phosphatic quartz sands, clays and carbonates (Scott, 1986). The Nocatee is predominantly a clastic (sand and clay) unit. Quartz sands are typically fine to coarse grained, sometimes silty, clayey, calcareous or dolomitic and variably phosphatic (Scott, 1986). Clay beds are common. The clays are variably quartz sandy and silty, phosphatic and calcareous to dolomitic. Carbonate beds are subordinate within the Nocatee (Scott, 1986).

The Nocatee within Polk County is present only in the southwestern corner of the county. The top of the formation is encountered at elevations which range from 81 to 150 feet below MSL (Scott, 1986). Thickness of the Nocatee ranges from less than 50 to slightly more than 100 feet. The upper surface dips generally to the south and southeast. The limits of the formation are primarily by facies change (Scott, 1986).

The Tampa Member of the Arcadia Formation is lithologically similar to the type Tampa Formation of King and Wright (1979), but has a slightly greater phosphate content (1-3 percent) and greater areal extent (Scott,

Peace River Formation

The Peace River Formation includes two members: a downdip, unnamed member and the updip Bone Valley Member [formerly the Bone Valley Formation (Matson and Clapp, 1909)] (Scott, 1986). Lithologically, the unnamed member consists of yellowish gray to light olive-green interbedded sands, clays and dolomite with variable phosphate content which, in the past, have been described as "upper Hawthorn clastics" (Scott, 1986). Scott (1986) defines the Bone Valley Member as "all the phosphorite pebble or gravel bearing beds with sand-sized phosphorite in a sandy to clayey matrix."

The Peace River Formation is present throughout Polk County with the exception of the northernmost part of the county. The Bone Valley Member is present only in the western part of the county and thins in all directions from a center of deposition located in the Bartow-Mulberry area (Bernardi and Hall, 1980; Scott, 1986). Throughout much of the area underlain by the Bone Valley Member the Bone Valley comprises the entire Peace River section, with the Bone Valley directly overlying the Arcadia (Scott, 1986). In southernmost Polk County the Bone Valley interfingers laterally and vertically with the undifferentiated Peace River. In the eastern part of the county, only the undifferentiated Peace River is present (Scott, 1986).

The Bone Valley Member of the Peace River is found at elevations as high as 175 feet above MSL in southwestern Polk County. The top of the Bone Valley throughout much of its extent occurs above 100 feet MSL (Scott, 1986). In Polk County the top of the Peace River dips to the east and is found at depths slightly greater than 50 feet below MSL. The thickness of the Peace River is generally less than 50 feet in Polk County (Scott,

1986). The Bone Valley Member has a maximum thickness of approximately 50 feet.

Pliocene-Pleistocene Series

Undifferentiated surficial sands, clayey sands and clays blanket essentially all of Polk County. These sediments range in age from Pliocene (T. Scott, 1986, personal communication) to Pleistocene (5.3 million years to 10,000 years ago). The Lake Wales and Winter Haven ridges, are composed of clayey, micaceous, quartz pebbly sands which in the past have been described as "Miocene coarse clastics". These sediments are presently thought to be Pliocene in age (T. Scott, 1986, personal communication) and are included in the undifferentiated surficial sediments for the purpose of this report.

In general, the surficial sediments are thinnest in the southwest portion of the county and are thicker to the north and east and beneath the ridges. The thickness of undifferentiated surficial sediments ranges from less than 10 feet to more than 120 feet.

Holocene Series

Deposits of Holocene age (10,000 years ago to present) are primarily limited to present day stream flood plains, beaches, swamps, marshes and lakes. These sediments consist of sand, silt, clay and organic materials.

HYDROLOGY

Groundwater in Polk County is obtained from the surficial aquifer system, the intermediate aquifer system and from the Floridan Aquifer. The aquifers are separated by confining layers which restrict vertical water movement between the aquifer systems. The hydrogeological units utilized

here are those presented by the Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition (1986).

Surficial Aquifer Systems

The surficial aquifer consists primarily of quartz sand and includes the undifferentiated surficial sands and clay as well as the uppermost portions of the Peace River Formation. The top of the surficial aquifer is the ground-water table and water within the surficial aquifer is generally under unconfined conditions. The base of the surficial aquifer system is formed by the clayey, less permeable beds of Peace River Formation. The surficial aquifer system underlies essentially all of Polk County and is utilized primarily for domestic and low volume irrigation uses where high flow rates are not required (Stewart, 1966).

Intermediate Aquifer System

The intermediate aquifer system, present over much of western Polk County south of Polk City, contains water under confined conditions and consists primarily of the limestones and dolomites of the Arcadia Formation. The intermediate aquifer corresponds with the "secondary artesian aquifer" of Stewart (1966). The upper confining layer of the intermediate aquifer system consists of the clayey sediments of the Peace River Formation. The lower confining layer consists of the Nocatee Member of the Arcadia Formation. Locally the intermediate aquifer and the Floridan Aquifer are in direct contact, or are hydrologically connected where confining beds are absent or have been breached (Stewart, 1966).

The intermediate aquifer system in Polk County ranges from about 10 to 150 feet thick (Stewart, 1966; Scott, 1986). The principal uses for this aquifer include domestic, truck farm irrigation and some large volume

citrus irrigation (Stewart, 1966).

Floridan Aquifer

The Floridan Aquifer in Polk County consists of the persistent vertically permeable portions of the Avon Park (combined with the Lake City Limestone by Miller, in press), Ocala Group and Suwannee limestones (Stewart, 1966). In the eastern portion of the county where confining beds at the base of the Hawthorn Group are thin or missing, the Floridan includes the permeable portions of the Arcadia Formation which are in hydrologic contact with the remainder of the aquifer.

The Floridan Aquifer is the principal aquifer in Polk County and is the source of all major municipal, industrial and irrigation water supplies (Stewart, 1966). The Floridan is an artesian aquifer throughout much of the county. In the general area north of Polk City, however, the confining layers have been removed by erosion and the Floridan is unconfined. In this area the top of the Floridan is at about 100 feet above MSL. The top dips generally to the south, southeast and southwest and is at about 250 feet below MSL in the southeastern and southwestern corners of the county (Buono and Rutledge, 1978).

ECONOMIC GEOLOGY

Phosphate, byproduct uranium and fluorine, limestone, peat, construction and industrial sand are presently being produced in Polk County.

Phosphate

Phosphate rock is the mineral commodity of greatest economic importance in Polk County. The majority of the Central Florida Phosphate District is located in southwest Polk County. Eight companies are presently

mining phosphate in Polk County. Florida has led the nation in phosphate production for over 90 years; the bulk of this production is from Polk County (Boyle and Hendry, 1985).

Byproduct Uranium and Fluorine

Uranium and fluorine are byproduct resources which can be recovered from the phosphoric acid produced by the acidulation of phosphate rock. The phosphate deposits of the Central Florida Phosphate District contain an average of 0.015 percent U_3O_8 (Sweeney and Windham, 1979) and 3-4 percent fluorine (Nash and Blake, 1977).

With present technology approximately one pound of U_3O_8 is recoverable from a ton of P_2O_5 (Sweeney and Windham, 1979). Under present economic conditions only those companies with long term contracts are producing by-product uranium. The uranium produced is utilized primarily by the electric power generation industry.

When phosphate rock is treated to produce phosphoric acid approximately 40 percent of the fluorine present in the phosphate rock is volatilized forming silica-tetrafluoride (SiF_4). The fluorine recovered is utilized to produce compounds for the chemical industry and for water fluoridation (Boyle and Hendry, 1985). Under current economic conditions, much of the recoverable fluorine is not recovered.

Limestone

Limestone resources are limited in Polk County. Although extensive limestone deposits are present, the impure nature of the limestone, coupled with excessive overburden thickness, prevent economic utilization throughout much of the county. The only limestone mining in the county is in the extreme northwestern corner of the county.

Peat

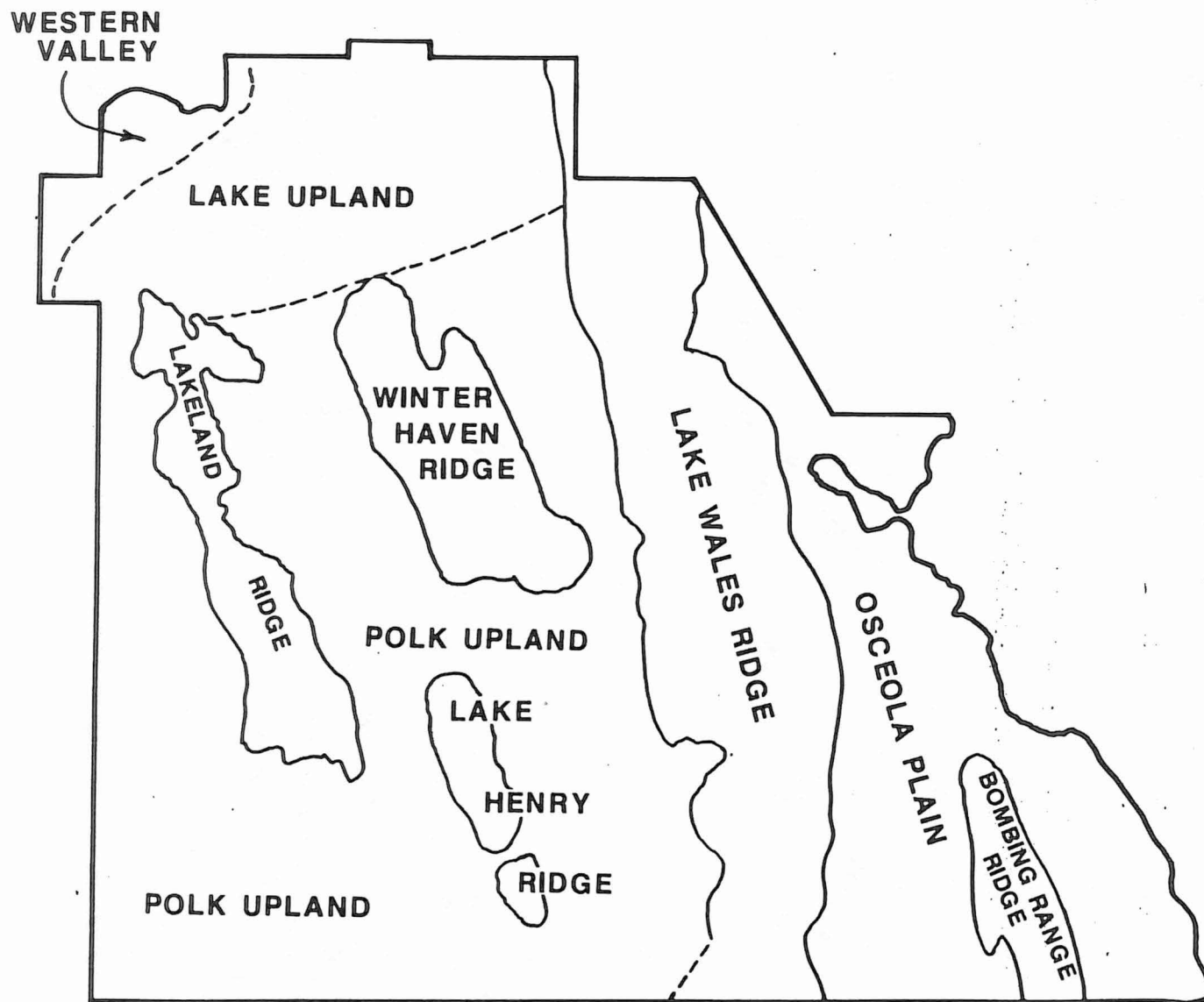
Several peat mining operations are active in Polk County. The majority of this product is utilized to improve soil conditions, for nursery uses and for potting soils.

Sand

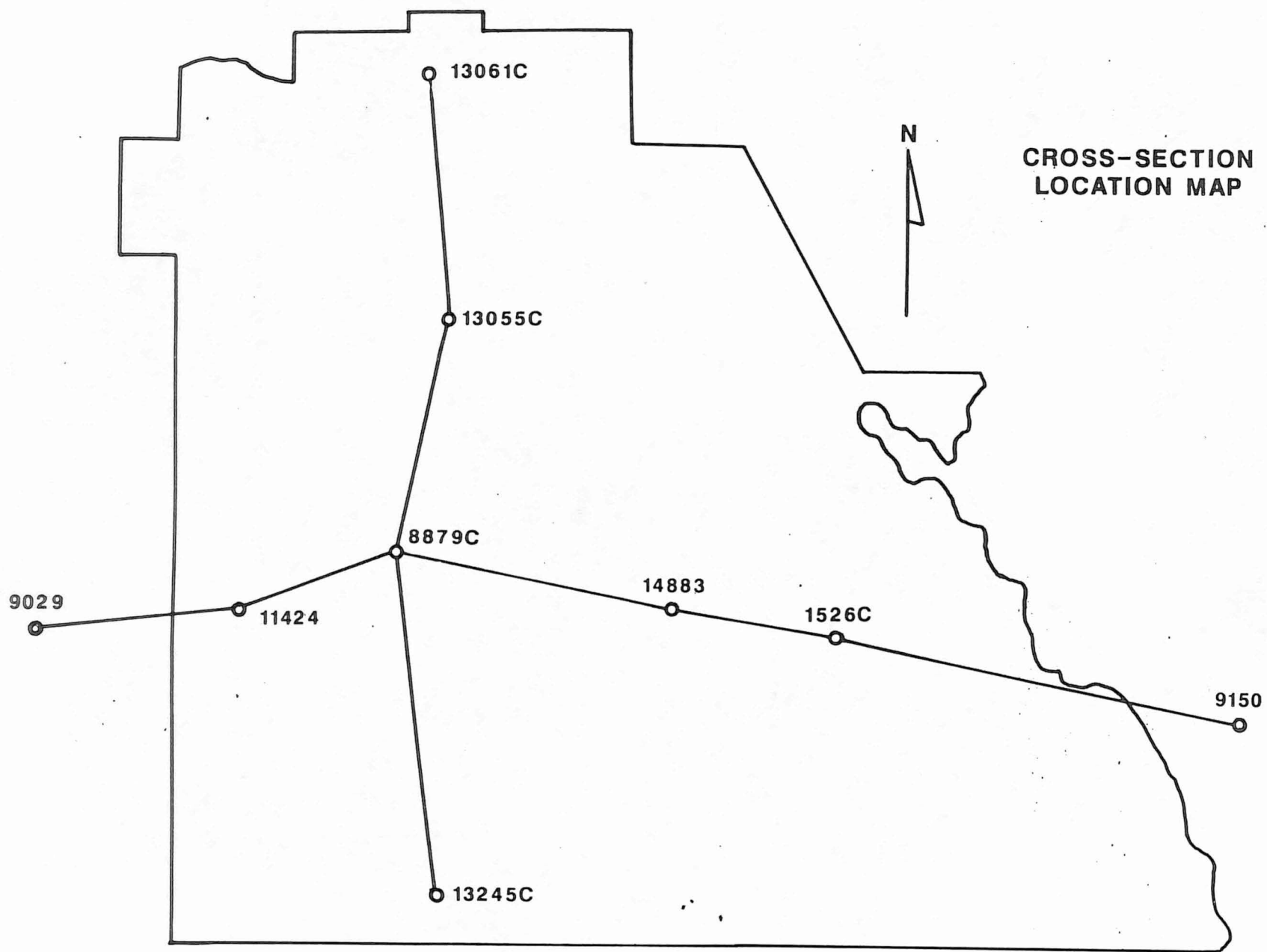
Several companies are mining construction and industrial sand in Polk County. The primary areas of development are in the vicinity of Polk City and along the Lake Wales Ridge in the eastern part of Polk County.

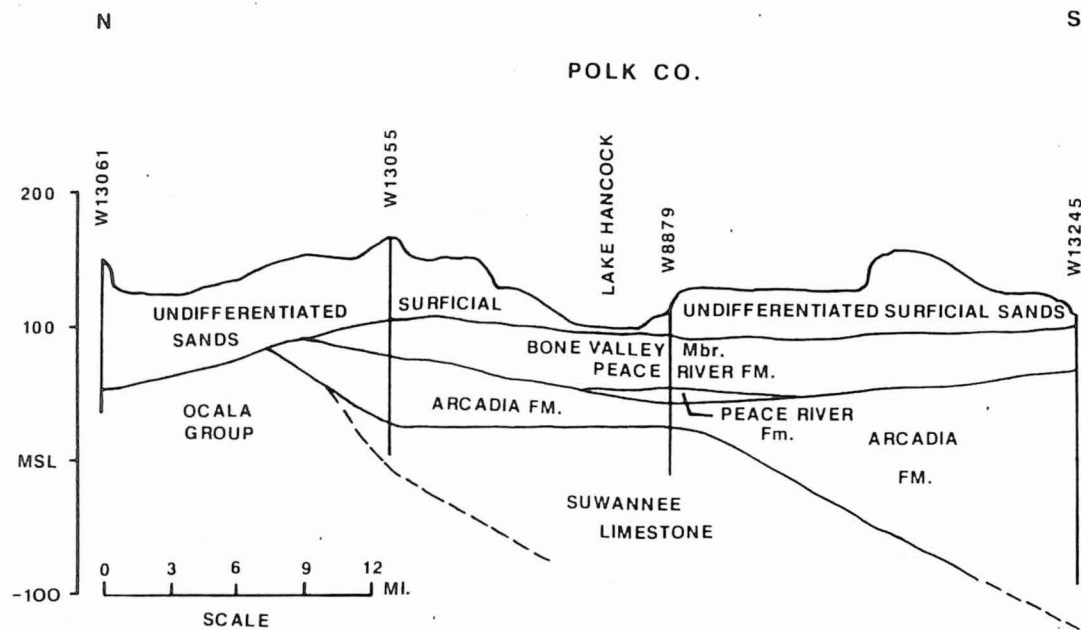
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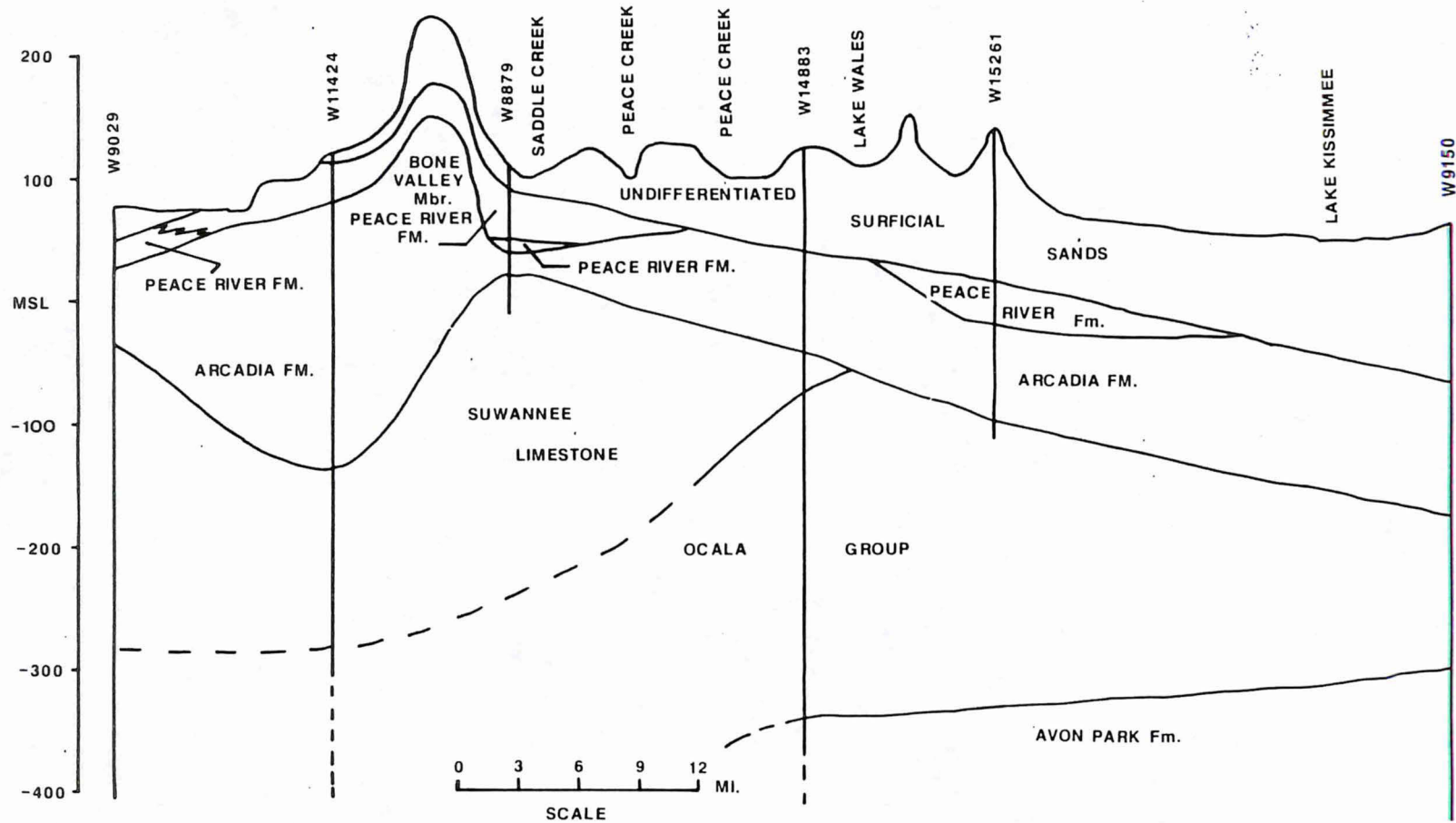
Generalized Physiographic Map of Polk County, after White (1970).





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