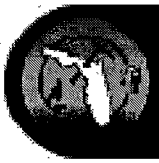

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Open File Report 6

Geology of Hillsborough County, Florida

by

Kenneth M. Campbell

Florida Geological Survey
Tallahassee, Florida
1984

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OPEN FILE REPORT 6

GEOLOGY OF HILLSBOROUGH COUNTY

By:
Kenneth M. Campbell
Florida Geological Survey

Physiography and Drainage

The terrain of western Hillsborough County is flat and low lying. The eastern part of the county is gently rolling and higher in elevation. The notable physiographic features of the area are related to ancient stands of the seas which once covered the region. Relict shorelines are evidenced by subtle linear escarpments, which in much of the area, have not been significantly altered by fluvial (river) processes. Four ancient shorelines are preserved in Hillsborough County. The Pamlico, Talbot, Penholoway and Wicomico shorelines stand at or near 25, 42, 70 and 100 feet above present mean sea level respectively.

Hillsborough County is divided into several physiographic features. These physiographic features are the Polk Upland, Desoto Plain, Gulf Coastal Lowlands and the Western Valley (White, 1970) (See physiographic map).

Polk Upland

The Polk Upland occupies much of the eastern part of the county at elevations which range from 100-160 feet. The terrain is gently rolling. The Bone Valley Member of the Peace River Formation underlies most of the upland (White, 1970). Due to the

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presence of clayey material in the Bone Valley, karst features are not characteristic of the Polk Upland, although there is a scattering of sinkholes in the Brandon area. Within Hillsborough County, the Upland is drained by the Alafia and Little Manatee rivers and their tributaries. The Upland is bounded on the west by a western facing scarp (the Wicomico shoreline) which slopes downward to the Desoto Plain and the Gulf Coastal Lowlands in central Hillsborough County and to the Hillsborough River Valley in the northern part of the county.

Desoto Plain

The Desoto Plain forms part of the southern and western boundaries of the Polk Upland. Only a small portion of a northward extending arm of the Desoto Plain is present in Hillsborough County. The inconspicuous scarp which separates the plain from the Polk Upland has elevations of 75-80 feet at the toe (White, 1970). The Desoto Plain is similar to the Polk Upland but is lower in elevation, has less relief and is more poorly drained.

Western Valley

The Hillsborough River flows in a southwesterly direction through the north-central part of the county and occupies the southern end of the Western Valley (White, 1970). The Withlacoochee River occupies the Western Valley north of the difference of the Withlacoochee and Hillsborough rivers from their common headwaters (the upper Withlacoochee River). Occasionally,

the Withlacoochee overflows into the Hillsborough through a topographic low (White, 1958). White (1958) believed there is evidence that the Western Valley originally contained a single stream which flowed into Hillsborough and Tampa bays. Deep sands cover much of the Western Valley, with the result that these areas are well-drained. Portions of the Hillsborough River Valley are swampy; however, there are relatively few lakes present.

Gulf Coastal Lowlands

The Gulf Coastal Lowlands encompass northwestern Hillsborough County, the interbay peninsula and extend several miles inland from the present coast in the southern part of the county (White, 1970). The Pleistocene age (10,000 - 1.6 million years ago) terraces are located within the coastal lowlands. Dune fields are often associated with the terrace deposits. The terrace deposits were developed on sediments of the Peace River Formation in southern Hillsborough County, while in the northern part of the county, the terraces were developed on a clayey residuum of the Hawthorn Group or locally directly on limestone of the Tampa Member of the Arcadia Formation.

The coastal lowlands, in southern Hillsborough County are fairly well-drained by the Alafia and Little Manatee rivers and their tributaries. Numerous lakes and swamps are present in the less well-drained central-western portion of the county. A large portion of northwestern Hillsborough County is riddled with

sinkholes due to the absence or thinning of the clayey residuum of the Hawthorn Group. This area is low, poorly drained and swampy. Many of the sinkhole lakes are in direct hydrologic contact with the Tampa Limestone, with the consequence that water levels fluctuate in response to the potentiometric surface of the Floridan Aquifer.

Stratigraphy

Oligocene Series

Suwannee Limestone

The Suwannee Limestone occurs in the subsurface throughout Hillsborough County and is the oldest geologic formation which is exposed at the surface in the county. The Suwannee is found near the ground surface in the northeastern part of the county and is exposed in the Hillsborough River bed. In all other parts of the county, the Suwannee is overlain by the Tampa Member of the Arcadia Formation.

Lithologically, the Suwannee Limestone can be divided into three units in Hillsborough County. The lowermost unit is a yellowish-grey microcrystalline (less than 1/16mm) limestone which contains minor amounts of peat, pyrite and clay. The limestone is chalky and has low intergranular porosity. Microfossils and macrofossil fragments are fairly common (Wright and MacGill, 1974).

The middle unit is a cream to yellow, skeletal limestone, composed almost entirely of medium (1/4 - 1/2mm) to coarse (1/2 -

1.0 mm) sized skeletal fragments. This unit is highly recrystallized and exhibits good intergranular and vugular porosity. Foraminifera and mollusc fragments are the primary fossils (Wright and MacGill, 1974).

The uppermost unit of the Suwannee Limestone, as described by Wright and MacGill (1974) is a pale yellow, finely crystalline limestone which contains minor amounts of fine (1/8 - 1/4mm) quartz sand. The carbonate grains range from fine (1/8 - 1/4mm) to coarse (1/2 - 1mm) in size and consist primarily of foraminifera and mollusc fragments. Portions of the upper unit are recrystallized, but more commonly the unit is chalky and has low to moderate intergranular and moldic porosity.

The Suwannee dips to the south and southwest and thickens to the southwest. The thickness of the Suwannee, in the county, ranges from just under 100 feet to more than 300 feet. The top of the Suwannee Limestone is encountered at about 50 feet above mean sea level in northeastern Hillsborough County and dips to about 300 feet below mean sea level at the southern border.

Miocene Series

Hawthorn Group

Scott (1984, personal communication, manuscript in preparation) intends to raise 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.

Arcadia Formation

The Arcadia Formation (Scott, 1984, personal communication) consists of, in ascending order, the Nocatee Member, the Tampa Member and an unnamed upper member.

The Nocatee Member consists of the "lower Tampa" or "Tampa sand and clay unit" of Wilson (1977). The updip limits of the Nocatee are not well-defined at this time, however, the unit extends into southern and eastern most Hillsborough County where it is believed to be present as a thin (several feet) clay layer often described in the past at the base of the Tampa Limestone (Scott, 1984, personal communication).

The Tampa Member overlies the Nocatee (where it is present) or the Suwannee Limestone and 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 limits (Scott, 1984, personal communication). 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, 1984, personal communication). Some beds within the Tampa Member contain more than 50 percent quartz sand. Dolomite is relatively uncommon within the Tampa Member, and the upper beds are locally silicified (King and Wright, 1979; Scott, 1984, personal communication).

The lower boundary of the Tampa Member is gradational with the top of the underlying Suwannee Limestone. King (1979) arbitrarily set the boundary for the Tampa Formation at the point

where quartz sand content decreased to less than 5 percent of the rock volume. Scott (1984, personal communication) has maintained this criteria for the Tampa Member.

The contact at the upper boundary of the Tampa Member is gradational where the upper member of the Arcadia Formation is present. The contact is sharp in the most updip areas of the Tampa Member where undifferentiated sands immediately overlie the Tampa (Scott, 1984, personal communication).

The Tampa Member is present in the subsurface over most of the county and is exposed in many areas, especially within the Hillsborough River Valley. The Tampa has been removed by erosion in a band along the eastern part of northernmost Hillsborough County. In this area, the Suwannee Limestone is the first formation encountered beneath the surficial sands (Wright and MacGill, 1974).

The Tampa dips generally to the southwest and thickens in the downdip direction. The top of the Tampa Member is encountered at just above mean sea level in northern Hillsborough County to approximately 260 feet below mean sea level in the southwestern corner of the county (King, 1979).

The uppermost (unnamed) member of the Arcadia Formation includes those sediments which in the past have been referred to as the "Hawthorn carbonate unit" (Scott, 1984, personal communication). Lithologically, these sediments consist of white to yellowish-grey, quartz sandy, phosphatic, sometimes clayey, dolomites and limestones (uncommon). Occasional beds of car-

bonate rich quartz sand and thin clay beds are present. Phosphate content averages 7-8 percent but can vary from just a trace to 30 percent (Scott, 1984, personal communication).

In portions of northwest Hillsborough County and the Hillsborough River Valley, limestones of the Tampa Member of the Arcadia Formation are overlain by irregular thicknesses of sandy calcareous clays. These clays are presently considered to be residual sediments derived from weathering of the Hawthorn Group. In the past, these sediments have been assigned to the Tampa, Hawthorn, Bone Valley, Alachua and Pleistocene by various authors.

Lithologically, these residual sediments consist of illites or mixed layer clays of illite (predominant) and montmorillonite which contain variable amounts of quartz sand, organic material and calcium carbonate. Calcium carbonate generally increases downward (Wright and MacGill, 1974).

Peace River Formation

The Peace River Formation proposed by Scott (1984, personal communication) includes two members: a downdip, unnamed member and the updip Bone Valley Member (formerly the Bone Valley Formation). Lithologically, the unnamed member consists of interbedded sands, clays and dolomite with variable phosphate content which, in the past, have been described as "upper Hawthorn clastics."

In many parts of Hillsborough County, the Peace River Formation is difficult to differentiate from the uppermost Arcadia due to the gradational nature of the contact and the northward thinning of the Peace River Formation. Both the upper member of the Arcadia Formation and the Peace River Formation pinch out in northern Hillsborough County; however, the Peace River pinches out farther to the south than the upper member of the Arcadia Formation.

The Bone Valley Member consists of a series of sands and clays which contain abundant quantities of phosphorite sand and gravel. Cathcart (1963) divided the Bone Valley Formation into a lower phosphorite unit and an upper unit of sandy clay.

The lower unit is a poorly sorted, highly phosphatic, quartz sand or clayey sand. Both the quartz sand and phosphorite range in size from fine to coarse (1/16 mm - 1.0 mm) (Gurr, 1977). Pebble-size phosphate beds are common (Bernardi and Hall, 1980). Phosphorite particles are generally rounded, well-polished (except when leached) and of variable color, generally brown, tan, amber, grey and black (Bernardi and Hall, 1980).

The upper unit consists of clayey sand which is significantly less phosphatic and more clayey than the lower unit. Sediments of the upper Bone Valley are difficult to differentiate from the surface sands in the area (Wright and MacGill, 1974).

Bone Valley sediments are present only in the eastern part of Hillsborough County. Bone Valley deposition was restricted to the north by the presence of the Hillsborough High and to the

west by the ancestral Valrico Ridge (Bernardi and Hall, 1980). Bone Valley sediments thin in all directions from a center of deposition located in the Bartow-Mulberry area of Polk County (Bernardi and Hall, 1980).

Pleistocene Series

Pleistocene shell deposits are located in the southwestern portion of the county in the vicinity of the mouth of the Little Manatee River. The shell deposits are overlain by thin surface sands (maximum of 5 feet) and are found at elevation less than 25 feet. The lithology of the deposit is quite variable, ranging from poorly indurated sand, shell and clay beds to lithified coquina (Knapp, 1980). The thickness of the shelly deposit is variable but generally increases toward Tampa Bay (Wright and MacGill, 1974).

Pleistocene terrace sands, deposited during higher sea level stands, blanket most of Hillsborough County. These sands are very fine to medium-grained (1/16mm - 1/2mm) quartz sands with a minor amount of heavy minerals. Generally, the sands are clean and white in color, however, locally they may contain some organic matter and may be iron stained. Thickness of the terrace sands ranges from a few inches to more than 50 feet in the Plant City area (Wright and MacGill, 1974).

The Pleistocene terrace sands overlie the clayey residuum of the Hawthorn Group in the northern part of the county. In the southwestern portion of the county, a thin veneer of Pleistocene

sand overlies the Pleistocene shell deposits. In the remainder of the county, the terrace sands overlie the sediments of the Peace River Formation.

Holocene Series

Holocene sediments within the county consist of fluvial, lacustrine, mangrove and swamp deposits. Lakes are most prevalent in northwest Hillsborough County. Lacustrine deposits consist of sand, silt and clay washed into lakes by storm water runoff, as well as organic material derived from the decay of aquatic plants within the lakes.

Fluvial deposits consist of sand, silt, clay and organic material deposited in the stream beds and flood plains of rivers and streams. The majority of such deposits occur along the Hillsborough, Alafia and Little Manatee rivers and their tributaries.

Mangroves trap sediment by reducing wave and current energy to the point where fine-grained sediments suspended in the water column can settle out. Swamp and bay head sediments consist of variable amounts of organic matter and sand, silt and clay. If clastic sediment influx is small, the organic sedimentation may result in predominantly organic deposits.

Industrial Minerals

Phosphate, uranium, portland cement, peat, shell and unclassified sand are presently being produced in Hillsborough County.

Phosphate

Phosphate rock is a mineral commodity of great importance to Hillsborough County. Phosphatic sediments are common throughout the county, however, the deposits of economic importance are located in eastern Hillsborough County where several companies are engaged in mining. The majority of the present production from the Central Florida Phosphate District, however, is from western Polk County. In 1981, Florida produced 83 percent of the total U. S. phosphate production (Stowasser, 1982), essentially all of which was shipped through the Port of Tampa either as raw phosphate rock or as phosphate products. In 1979, this accounted for 93 percent of all exports from the port (Boyle and Hendry, 1981).

Uranium

Uranium is a by-product resource which can be recovered from the phosphoric acid produced by the acidulation of phosphate rock. The phosphate deposits in the Central Florida Phosphate District contain an average of .015 percent U_3O_8 (Sweeney and Windham, 1979). With present technology, approximately one pound of U_3O_8 is recoverable from a ton of P_2O_5 from the central Florida phosphates. The 1980 capacity was projected at more than

2100 short tons, an amount which would provide approximately 15 percent of U.S. requirements (Sweeney and Windham, 1979). A significant amount of this resource will be recovered from facilities in Hillsborough County.

Portland Cement

Portland cement, although not strictly a mineral, is considered as a mineral resource. Cement is composed of limestone or lime, plus minor amounts of silica, alumina and iron. The final composition is determined by the product specifications but generally ranges from Ca_3SiO_5 to $Ca_4Al_2Fe_2O_{12}$ (Lefond, 1975). If the minor constituents needed are not present in the limestone, they are added by introducing materials which contain the desired components. Silica sand, staurolite (iron and alumina) and clay (silica, alumina and iron) are commonly added. Fly ash and slag are man-made substances which may be utilized for this purpose. The limestone and clay needed by the one plant in Hillsborough County has been obtained in the past from outside the county.

Limestone and Dolomite

Limestone resources are limited in Hillsborough 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 (Wright, 1974). Areas in northeast Hillsborough County may present viable future mining options (Schmidt, et al, 1979).

Peat

Several peat mining operations are active in the Mango-Seffner area of Hillsborough County. The majority of this product is utilized to improve soil conditions and for nursery and potting soils.

Shell

Shell is or has been produced from several areas in and around Tampa Bay. The Pleistocene shell beds provide good road metal and are extensively used for that purpose (Wright, 1974).

Sand

Sand pits for fill dirt are common throughout Hillsborough County, however, most area sands are too fine-grained for many construction purposes. The majority of the high quality construction sand needed in the county is shipped from the Lake Wales Ridge area of Polk County.

Glass sands (usually 99 percent pure SiO_2) were mined from the Plant City area of Hillsborough County in recent years. This deposit was of sufficient quality that beneficiation was not

required. Deposits similar to the Plant City deposit are present in the region (Wright, 1974) but further exploration is necessary.

Clay

Clay deposits and clayey sands are abundant throughout the county. The majority of these clays, however, are of a noncommercial nature.

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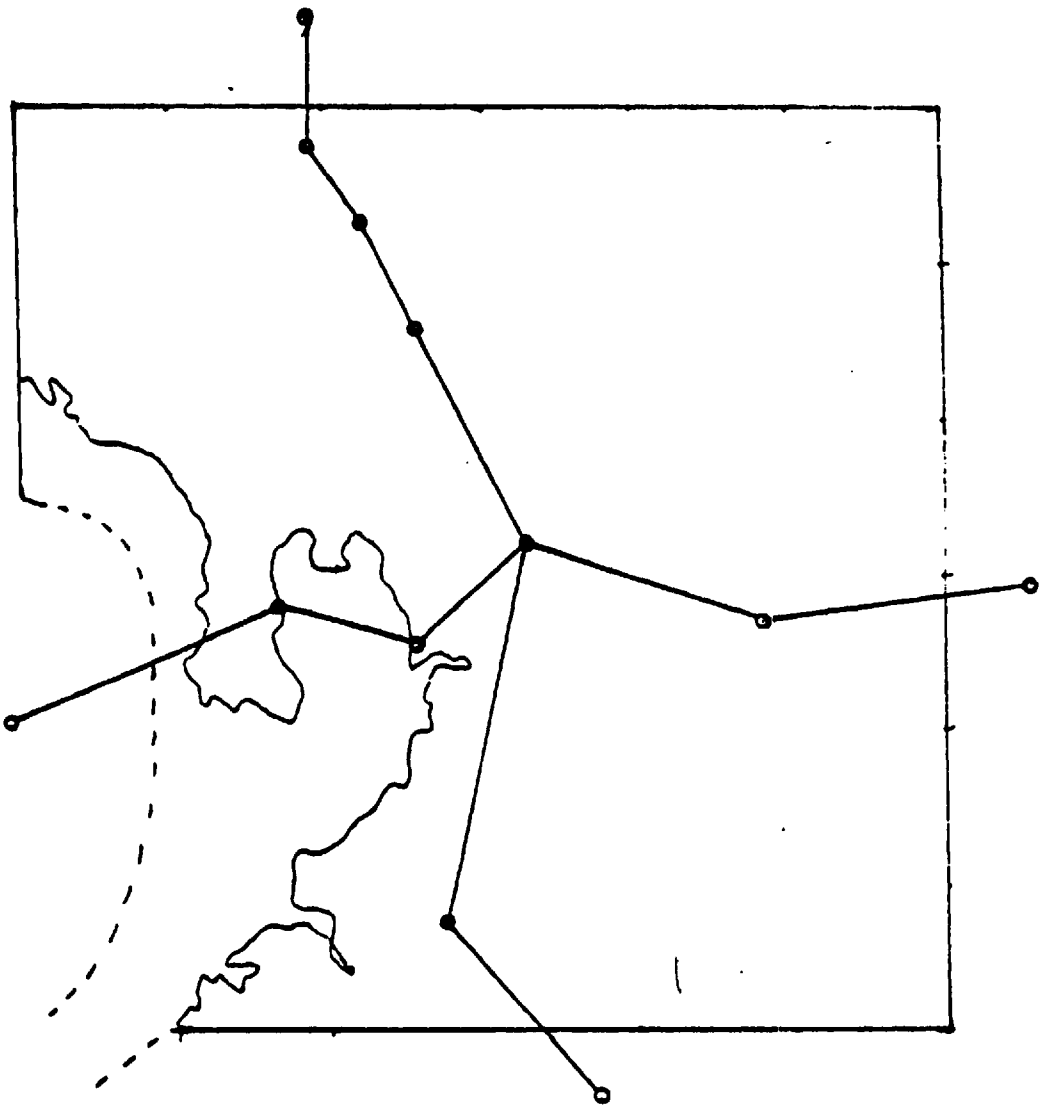
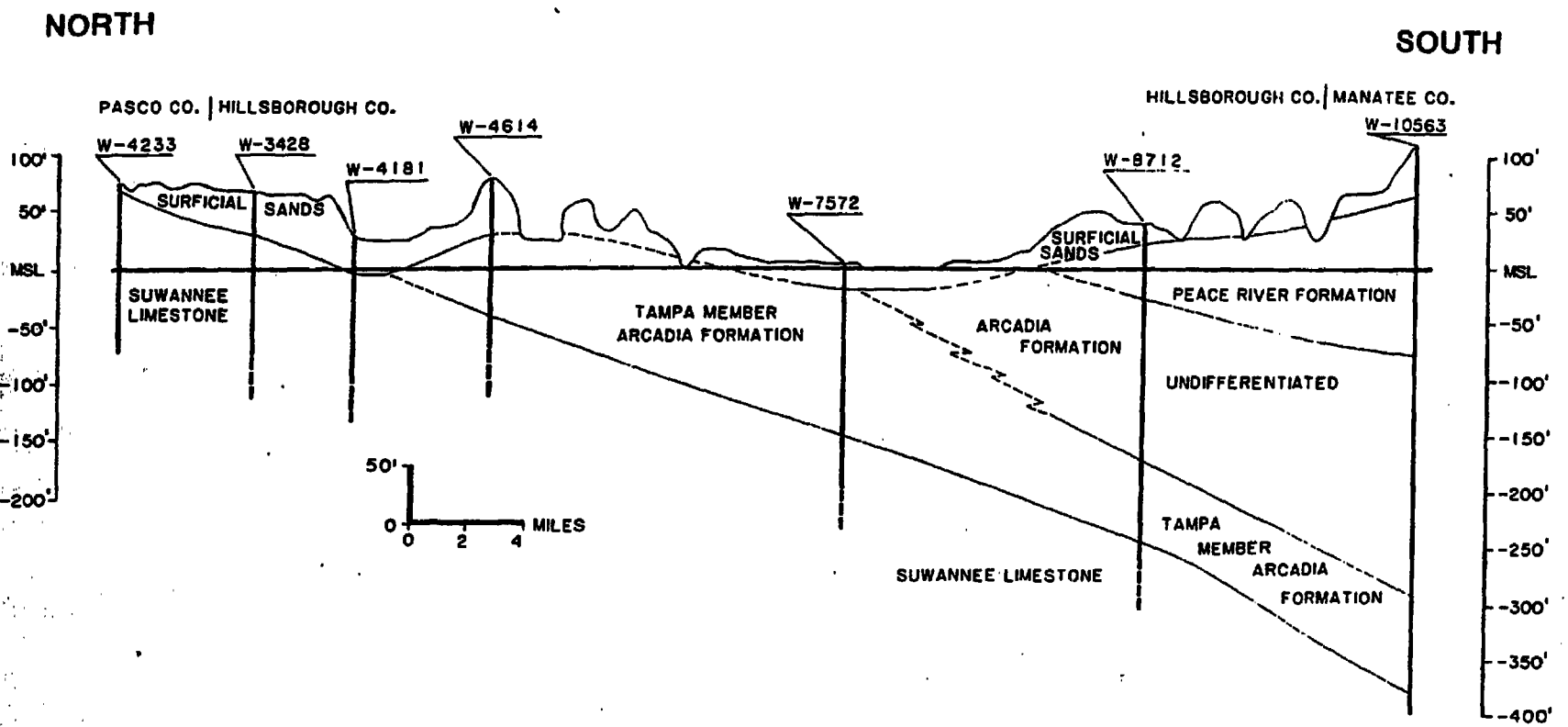


CROSS SECTION LOCATION MAP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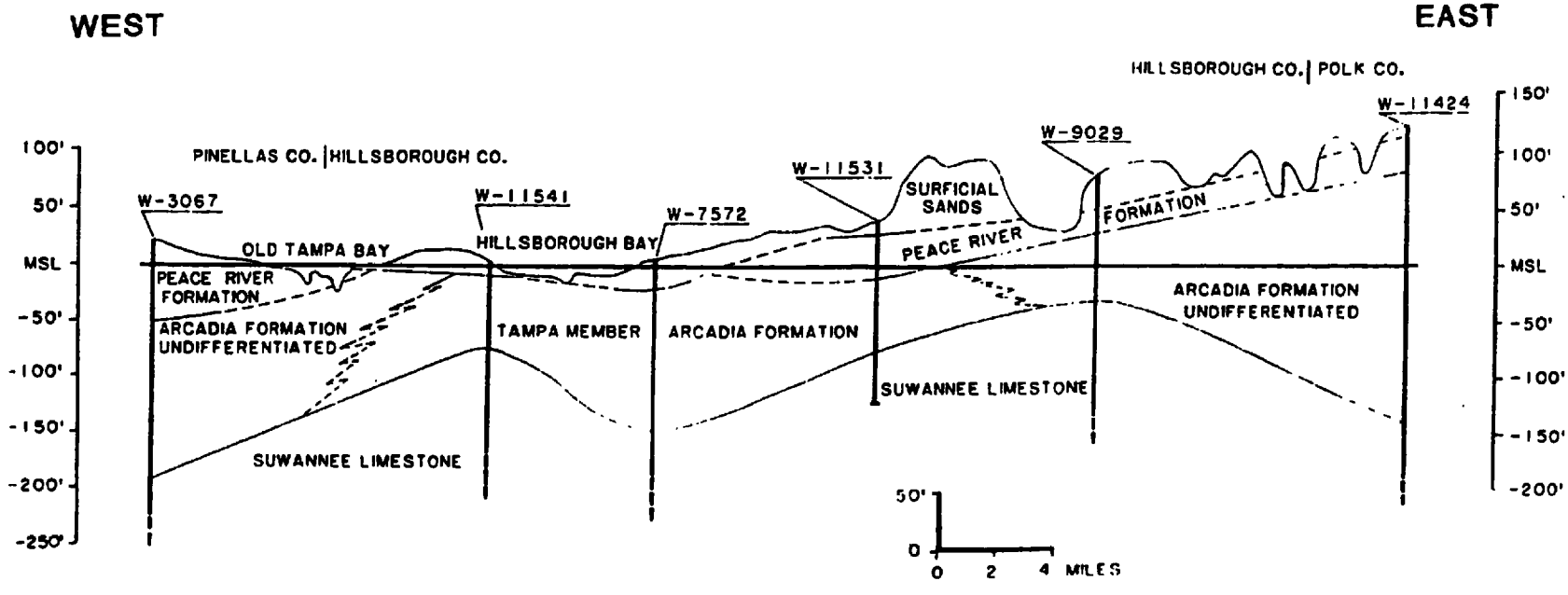
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SURFICIAL SANDS
PEACE RIVER FORMATION
PEACE RIVER FORMATION
ARCADIA FORMATION UNDIFFERENTIATED
TAMPA MEMBER
ARCADIA FORMATION
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