

REFERENCE

c. 2

STATE OF FLORIDA
DEPARTMENT OF NATURAL RESOURCES
Tom Gardner, *Executive Director*

DIVISION OF RESOURCE MANAGEMENT
Jeremy A. Craft, *Director*

FLORIDA GEOLOGICAL SURVEY
Walter Schmidt, *State Geologist*

OPEN FILE REPORT 33

THE GEOMORPHOLOGY, GEOLOGY AND HYDROGEOLOGY OF BAKER COUNTY, FLORIDA

By

Paulette Bond

FLORIDA GEOLOGICAL SURVEY
Tallahassee, Florida
1990

THE GEOMORPHOLOGY, GEOLOGY AND HYDROLOGY OF BAKER COUNTY, FLORIDA

GEOMORPHOLOGY

Baker County lies within the Proximal or Northern Zone of White (1970). This zone includes the western panhandle of Florida and extends to the east coast. The southern boundary of the Proximal Zone extends from the vicinity of Adams Beach in Taylor County to the boundary between St Johns and Flagler Counties. Within Baker County two subzones are defined based on topographic elevations. Most of Baker County is included in the Northern Highlands subzone, while a small area adjacent to Nassau and Duval counties falls within the Coastal Lowlands subzone.

Northern Highlands

The Northern Highlands subzone extends across northern Florida from its western boundary with Alabama east to Trail Ridge. This province continues north into Alabama and Georgia. (Figure 1). The Northern Highlands are bounded to the south and east by the Cody Scarp, a persistent and continuous slope which is broken only by the valleys of major streams (White, in Puri and Vernon, 1964). In Baker County the Northern Highlands vary in elevation from approximately 200 feet above mean sea level (msl) to approximately 95 feet msl. The province is underlain by Miocene sand, clay, dolomite and limestone. Miocene deposits are overlain by locally thick deposits of quartz sands which contain variable amounts of clay (Johnson, 1986). Baker County includes Trail Ridge and the Lake City Ridge, geomorphic subdivisions of the Northern Highlands (White, in Puri and Vernon, 1964), which

will be discussed separately.

Trail Ridge

White (in Puri and Vernon, 1964) includes Trail Ridge (Figure 1) as a geomorphic subdivision of the Northern Highlands. The feature is a linear ridge which is oriented approximately parallel to the present Atlantic coast line. Trail Ridge is narrow in Baker County but becomes more broad to the south. It occurs in southeastern Baker County where Baker is bounded by Nassau and Duval Counties. Trail Ridge attains topographic elevations ranging from 100 to 200 feet. The feature is underlain by quartz sand which contains clay and organic material as well as heavy minerals (Johnson, 1986). White (1970) proposes that Trail Ridge originated as a barrier island at a time when sea level was higher than it is presently.

The Lake City Ridge

The Lake City Ridge is a prominent ridge which is geographically related to Trail Ridge. Although it is reported to intersect Trail Ridge (Ceryak et al., 1983), a map of geomorphologic features (Brooks, 1981) does not show the intersection. This difference in interpretations is probably related to differing definitions for the boundaries of the ridges. Elevations on the Lake City Ridge range from 150 to 215 feet and are similar to those associated with Trail Ridge.

The Atlantic Coastal Lowlands

White (in Puri and Vernon, 1964) described the Atlantic Coastal Lowlands geomorphic subzone as including the land

adjacent to the Atlantic coast line of Florida. This area is low in elevation and locally, poorly drained. The geomorphic features which characterize the Atlantic Coastal Lowlands are underlain by a mixture of Miocene clay, sand, dolomite and limestone. The Miocene lithologies are blanketed by variable amounts of Pleistocene quartz sand and clay (Knapp, 1978). Geomorphic features of the Atlantic Coastal Plain are oriented approximately parallel to the present Atlantic coast line suggesting that their origin is related to marine processes. The Atlantic Coastal Lowlands includes a number of geomorphic subdivisions. Only one of these subdivisions, the Duval Upland occurs in Baker County.

Duval Upland

The Duval Upland (White, in Puri and Vernon, 1964), a geomorphic subdivision of the Atlantic Coastal Plain, occurs in southeastern Baker County adjacent to the boundary of Baker and Nassau Counties (Figure 1). It is bounded to the west by Trail Ridge and is part of a larger coast-parallel landform which extends eastward into Nassau and Duval Counties. The very small part of this feature which occurs in Baker County ranges in elevation from approximately 100 feet to approximately 50 feet and is characterized by medium to fine sand and clayey sand (Knapp, 1978).

STRATIGRAPHY

The oldest rocks penetrated by water wells in Baker County are the limestones of the Eocene age included in the Ocala Group

(Florida Geological Survey in-house well data). The youngest sediments present are undifferentiated surficial quartz sands and clayey sands of Pleistocene to Holocene age (Leve, 1968). The limestones of the Ocala Group and younger overlying limestone and siliciclastic (sandstone, silt and clay) units (Figures 2 and 3) are important freshwater aquifers and the following discussion of the geology of Baker County will be limited to these Eocene and younger units.

EOCENE SERIES

Ocala Group

Marine limestones of the Ocala Group (Puri, 1957) underlie all of Baker County (Leve, 1968). The Ocala Group includes three formations which are listed in ascending order; the Inglis Formation, the Williston Formation, and the Crystal River Formation. These formations are generally differentiated based on lithologic characteristics and fossils. In Baker County, however, the Inglis, Williston and Crystal River Formations consist of a fairly homogeneous sequence of cream to light grey, medium soft chalky to granular, marine limestones which contain thin beds of hard, massive dolomitic limestone and dolomite (Leve, 1968). Generally the Ocala Group contains abundant foraminifera, bryozoan fragments and whole and broken echinoid remains. The thickness of the Ocala Group in the vicinity of Baker County ranges from approximately 220 to 310 feet and averages about 250 feet. The upper surface of the Ocala Group ranges from approximately 200 to 550 feet below the surface of

the ground. The upper surface of the Ocala Group in Baker County dips to the northeast (Leve, 1968).

OLIGOCENE SERIES

Suwannee Limestone

The Suwannee Limestone lies unconformably above the limestones of the Ocala Group in the southwestern part of Baker County (Leve, 1968). It is described as a light grey to white, granular limestone which contains yellowish brown, indurated siltstone and calcium carbonate cemented sandstone. The Suwannee Limestone is less than 30 feet thick in Baker County and occurs at approximately 180 feet below the surface of the ground. The unit is absent over much of the county and may not have been deposited in these areas. Alternatively it may have been removed by erosion before deposition of the overlying Hawthorn Group (Leve, 1968).

MIOCENE SERIES

Hawthorn Group

The Hawthorn Group in Baker County unconformably overlies the Ocala Group limestones or the Suwannee Limestone in Baker County (Leve, 1968). The Hawthorn Group in north Florida includes four formations. In ascending order they are the Penney Farms Formation, the Marks Head Formation, the Coosawhatchie Formation, and the Statenville Formation (Scott, 1988). Locally, in Baker County the Coosawhatchie Formation may contain the Charlton Member (Johnson, 1986; Scott, 1988). In much of Baker County the Hawthorn Group is not differentiated into its component

formations since cores are required in order for the formations to be identified and few cores are available. Lithologically, the undifferentiated Hawthorn Group consists of interbedded quartz sand, clay and dolostone. The quartz sand varies in color from yellowish grey to light grey. It is poorly indurated and contains variable amounts of clay, dolostone and phosphate. The clay is yellowish grey to light olive grey with sand, dolomite, and phosphate. It is poorly to moderately indurated. The dolostone is light grey to olive grey and contains sand, clay and phosphate. It is poorly to well indurated and contains fossil molds scattered throughout (Johnson, 1986). The undifferentiated Hawthorn Group varies in thickness from approximately 125 feet to about 350 feet (Scott, 1988). The upper surface of the Hawthorn Group lies from approximately 20 feet below the surface to approximately 170 feet below the surface. Where core data of good quality is available, the Hawthorn Group may be differentiated into its constituent formations (Scott, 1988). In Baker County the Coosawhatchie Formation has been recognized in a core (Johnson, 1986). It consists mainly of quartz sand with lesser amounts of dolomite and limestone. The Coosawhatchie Formation sometimes contains a recognizable subunit, the Charlton Member. Where the Charlton Member is described in Baker County it consists of sandy limestone and calcareous, clayey, quartz sand with mollusk molds commonly present. The Charlton Member is restricted in its occurrence to southeastern Baker County where it lies at the top of the Coosawhatchie Formation and varies in thickness from less than one foot to about 20 feet. The Charlton

Member occurs at about 160 feet below the surface in Baker County (Johnson, 1986). The Statenville Formation consists of interbedded phosphatic sands, dolostones and clays and may extend into northwestern Baker County (Scott, 1988).

UNDIFFERENTIATED POST-MIOCENE SEDIMENTS

The upper surface of the Hawthorn Group in Baker County is blanketed by deposits of unconsolidated to poorly consolidated quartz sand which contains variable amounts of clay. In the area of the county which lies within the Northern Highlands these sands vary in thickness from approximately 20 feet to, locally, 100 feet (Florida Geological Survey in-house well data). Sands in the vicinity of Trail Ridge and the Lake City Ridge are thicker. In one well from Baker County which completely penetrates the post-Miocene sequence, a thickness of 162 feet is observed (Johnson, 1986). The thickness of sands associated with the Duval Upland in Baker County cannot be documented since well coverage is not available for that area. Sand from the Northern Highlands is fine-to-medium-grained and contains only trace amounts of heavy minerals (Johnson, 1986). In contrast, sand from the Trail Ridge area is characteristically fine-to-coarse-grained with common heavy minerals and organic matter. In sand of the Northern Highlands, clay occurs mixed with sand, while at Trail Ridge clay occurs both mixed with sand or in discrete scattered clay beds (Johnson, 1986).

HYDROGEOLOGY

Ground water fills the pore spaces and voids within

subsurface rocks and sediments. In Baker County most of this water comes from local rainfall and downward seepage of water from surface streams and marshes. Ground water withdrawn from Baker County may come from either of three aquifer systems including the surficial aquifer system, the intermediate aquifer system and the Floridan aquifer system (Southeastern Geological Society Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition, 1986; Leve, 1968).

Surficial Aquifer System

The surficial aquifer system (Southeastern Geological Society Ad Hoc Committee, 1986) of Baker County includes upper Miocene sediments of the Hawthorn Group in addition to post-Miocene sediments which are not differentiated in this report. Although these sediments range in thickness from approximately 30 to 150 feet, the permeable beds of the aquifer occur generally within the uppermost 50 feet of these deposits (Leve, 1968). These permeable sand and shell beds are not continuous and tend to form lenses which are bounded by less permeable silty clay beds. The surficial aquifer system is recharged mainly by local rainfall and downward seepage from surface streams and marshes. Water leaves the aquifer or, is discharged by evapotranspiration and seepage into streams, lakes, and swamps when their water levels are lower than the water level in the aquifer (Leve, 1968). In addition discharge occurs by downward movement or percolation into deeper aquifers and pumpage by wells in the county. Water from the surficial aquifer system may be high in iron causing it to taste bad and stain plumbing fixtures. It is

used locally for rural domestic, stock and irrigation since it is relatively inexpensive to acquire (Leve, 1968).

Intermediate Aquifer System

The intermediate aquifer system (Southeastern Geological Society Ad Hoc Committee, 1986). of Baker County consists of comparatively thin, discontinuous lenses of sand, shell, and carbonate. These permeable lenses occur within the relatively impermeable beds of clay and clayey sand within the Hawthorn Group. The impermeable beds are referred to as the intermediate confining unit (Southeastern Geological Society Ad Hoc Committee, 1986). Clay beds and beds of clayey sand may serve to restrict the vertical movement of water so that water may exist under artesian pressure within some permeable layers (Leve, 1968). The occurrence of these permeable lenses is variable in Baker county and their location cannot be predicted. The aquifer system is recharged by downward movement of water from the shallow aquifer system. Wells which penetrate the intermediate aquifer system generally yield more water with a lower iron content than wells penetrating the shallow system. Water from the intermediate aquifer system is used for domestic, stock, and irrigation supplies (Leve, 1968).

Floridan Aquifer System

The Floridan aquifer system is the main water supply source in northeastern Florida and southeastern Georgia. In Baker County the Floridan aquifer system consists mainly of permeable limestone and dolomite units which are Eocene in age. In

restricted areas of the county the Suwannee Limestone of Late Oligocene age and limestone beds of the Hawthorn Group of Miocene age may be part of the Floridan aquifer system (Leve, 1968). The Floridan aquifer system underlies all of Baker County and its upper surface ranges from approximately 50 feet below mean sea level in western Baker to more than 350 feet in the eastern part. The thickness of the Floridan aquifer system is not known in Baker County, although it is known to be more than 1600 feet thick in southwestern Baker and approximately 1900 feet thick in the northeastern part (Leve, 1968). The relatively impermeable sediments of the Hawthorn Group serve to confine the Floridan aquifer system in Baker County. The aquifer system is recharged primarily in areas where the intermediate confining unit is thin or breached by streams or sinkholes. In these areas water may move downward into the aquifer system. Water from the Floridan aquifer system is discharged by upward seepage and also from wells (Leve, 1968).

MINERAL RESOURCES

Currently, no mineral resources are being mined commercially in Baker County (Campbell, 1986; Spencer, 1989). Clayey sands of post-Miocene age have some potential for use as fill material. Limestone is deeply buried by post-Miocene clayey sands and also by the siliciclastics and discontinuous dolostones and limestones of Miocene age. The occurrence of peat deposits is suggested by extensive wetland areas in northern Baker County, but no data is currently available to document their occurrence (Bond et al.,

1986). Although neither phosphate nor heavy minerals are mined in Baker County at present they will be discussed briefly since future development of those resources is possible.

Phosphate

Baker County lies within the Northern and Northeast Florida Phosphate Districts (Campbell, 1986). Scott (1988) notes that phosphate production in north Florida is from the Statenville Formation of the Hawthorn Group and is restricted to eastern Hamilton County (Northern District). This formation may occur in a very limited area of northwestern Baker County. Eastern Baker County lies within the Northeast District where phosphate occurs at approximately 200 feet below land surface (Scott, 1988). Currently phosphate is not mined in Baker County. This is probably due to economic factors related to the thickness of overburden as well as the relative enrichment of phosphate within the rock units which contain it. As alternate phosphate resources dwindle and technology improves, commercial exploitation of this resource might become a future option. The United States Geological Survey evaluated impacts associated with potential phosphate mining on the hydrology of the Osceola National Forest in a study conducted in 1978 (Miller, et al., 1978).

Heavy Minerals

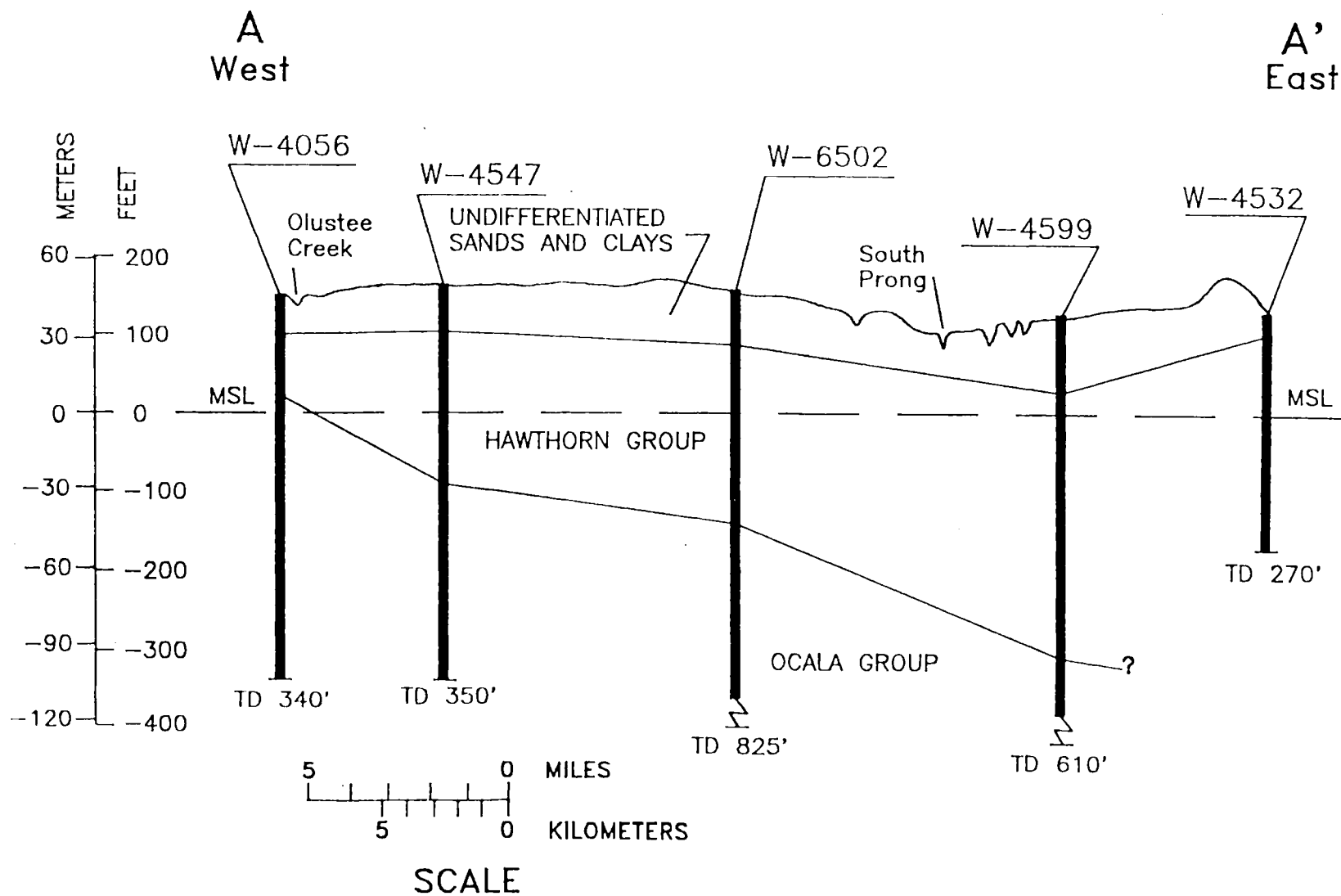
Trail Ridge is a linear ridge with a north-northwesterly orientation which occurs in eastern Baker County. It is also discussed here under the heading "Geomorphology". At the

southern end of Trail Ridge (located in Bradford and Clay counties) the ore body is mined commercially for heavy minerals. A core drilled on Trail Ridge in Baker County (Pirkle, et al., 1977) was found to have an ore zone approximately 35 feet thick. Heavy minerals from the ore zone include leucoxene and ilmenite. They occur intermixed with quartz sand, silt, clay, and organic matter (Pirkle, et al., 1977). Although heavy minerals are not mined currently in Baker County future development may be a possibility.

REFERENCES

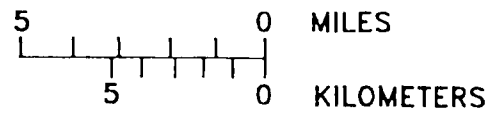
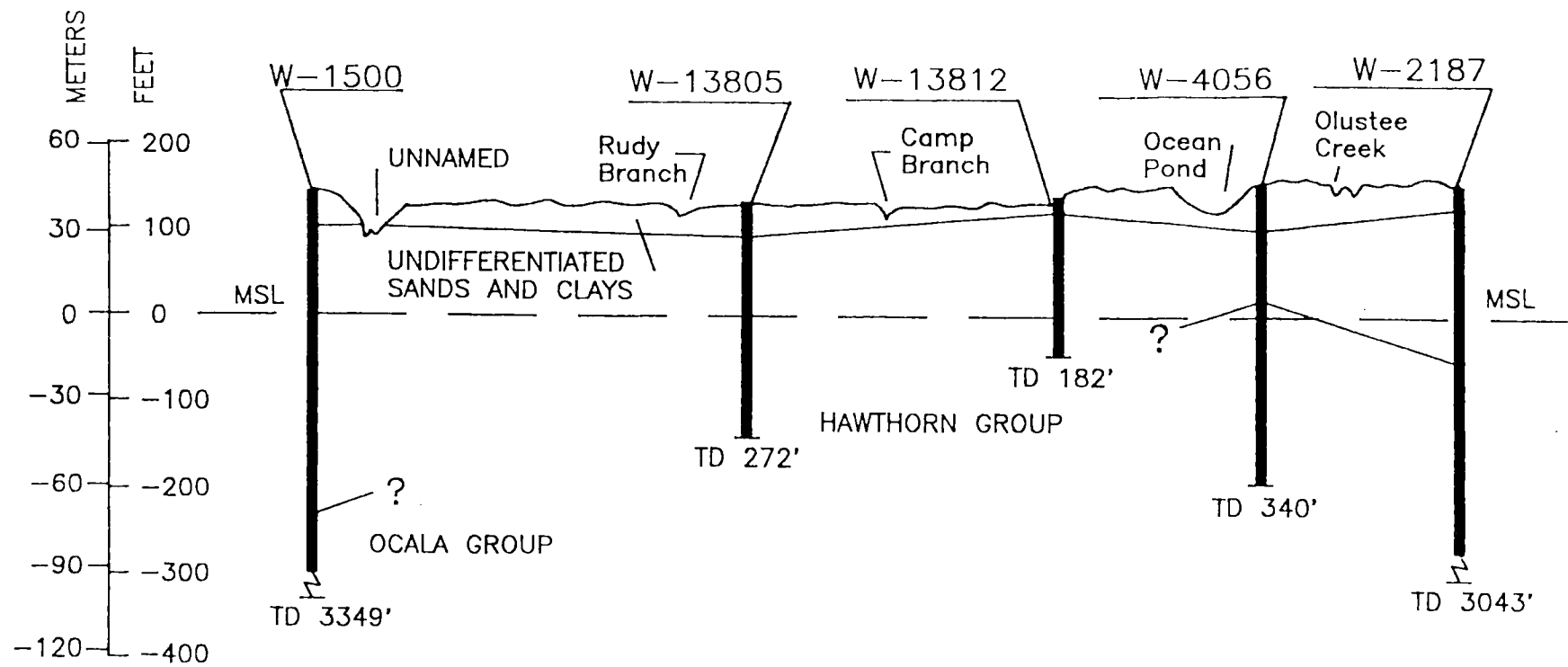
- Bond, P.A., Campbell, K.M., and Scott, T.M., 1986, An overview of peat in Florida and related issues: Florida Geological Survey Special Publication no. 27, 151 p.
- Brooks, H.K., 1981, Physiographic Divisions of the State of Florida: Florida Cooperative Extension Services, Institute for Food and Agricultural Sciences, University of Florida, Gainesville, 1 p.
- Campbell, K.M., 1986, The industrial minerals of Florida: Florida Geological Survey Information Circular no. 102, 94 p.
- Ceryak, R., Knapp, M.S., and Burnson, T., 1983, The Geology and Water Resources of the Upper Suwannee River Basin, Florida, Florida Geological Survey Report of Investigation no. 87, 165 p.
- Johnson, R.A., 1986, Shallow stratigraphic core tests on file at the Florida Geological Survey: Florida Geological Survey Information Circular no. 103, 431 p.
- Knapp, M.S., 1978, Environmental geology series Valdosta sheet: Florida Bureau of Geology Map Series no. 88, 1 p.
- Leve, G.W., 1968, Reconnaissance of the ground-water resources of Baker County, Florida: Florida Division of Geology Report of Investigations no. 52, 24 p.
- Miller, J.A., Gilbert, H.H., Hull, R.W., Vecchioli, J., and Seaber, P.R., 1978, Impact of potential phosphate mining on the hydrology of Osceola National Forest, Florida: U.S. Geological Survey Water-Resources Investigations 78-6, 159 p.

- Pirkle, E.C., Pirkle, W.A., and Yoho, W.H., 1977, The Highland heavy-mineral sand deposit on Trail Ridge in northern peninsular Florida: Florida Bureau of Geology Report of Investigation no. 84, 50 p.
- Puri, H.S., 1957, Stratigraphy and zonation of the Ocala Group: Florida Geological Survey Bulletin no. 38, 248 p.
- Puri, H.S. and Vernon, R.O., 1964, Summary of the geology of Florida and a guidebook to the classic exposures: Florida Geological Survey Special Publication no. 5, 312 p.
- Scott, T.M., 1988, The lithostratigraphy of the Hawthorn Group (Miocene) of Florida: Florida Geological Survey Bulletin no. 59, 148 p.
- Southeastern Geological Society Ad Hoc Committee, 1986, Hydrogeological units of Florida: Florida Geological Survey Special Publication no. 28, 8 p.
- Spencer, S.M., 1989, The industrial minerals industry directory of Florida: Florida Geological Survey Information Circular no. 105, Part I, 51 p.
- White, W.A., 1970, The geomorphology of the Florida peninsula: Florida Bureau of Geology Geological Bulletin no. 51, 164 p.



B
North

South



SCALE

39380000148430



FLORIDA GEOLOGICAL SURVEY

