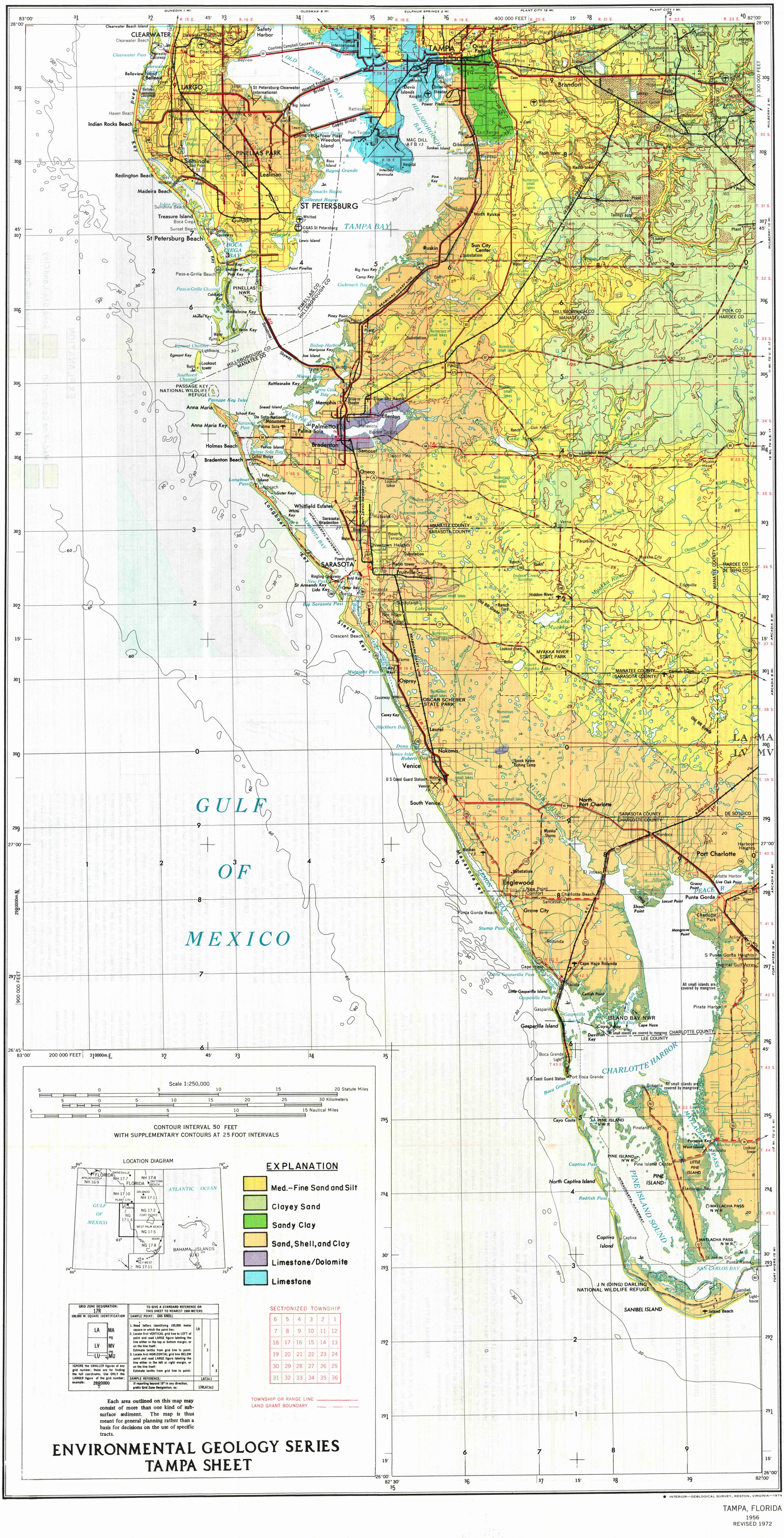
TAMPA

FLORIDA DEPARTMENT OF NATURAL RESOURCES
BUREAU OF GEOLOGY



Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 50 FEET
WITH SUPPLEMENTARY CONTOURS AT 25 FOOT INTERVALS

LOCATION DIAGRAM

EXPLANATION

- Med.–Fine Sand and Silt
- Clayey Sand
- Sandy Clay
- Sand, Shell, and Clay
- Limestone/Dolomite
- Limestone

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

TOWNSHIP OR RANGE LINE
LAND GRANT BOUNDARY

GRID ZONE DESIGNATION: 17R 100,000 M. SQUARE IDENTIFICATION	TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 1000 METERS
LA MA / LV MV / LU MU	SAMPLE POINT: OAK KNOLL 1. Read letters identifying 100,000 meter square in which the point lies: LA 2. Locate first VERTICAL grid line to LEFT of point and read LARGE figure labeling the line either in the top or bottom margin, or on the line itself: Estimate tenths from grid line to point: 7 3. Locate first HORIZONTAL grid line BELOW point and read LARGE figure labeling the line either in the left or right margin, or on the line itself: Estimate tenths from grid line to point: 3 SAMPLE REFERENCE: LA7343 If reporting beyond 18° in any direction, prefix Grid Zone Designation, as: 17RLA7343
IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figure of the grid number; example: 2880000 / 8	

Each area outlined on this map may consist of more than one kind of subsurface sediment. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

ENVIRONMENTAL GEOLOGY SERIES
TAMPA SHEET

● INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1974

TAMPA, FLORIDA
1956
REVISED 1972

FLORIDA DEPARTMENT OF NATURAL RESOURCES
BUREAU OF GEOLOGY

ENVIRONMENTAL GEOLOGY SERIES
TAMPA SHEET

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DIVISION OF RESOURCE MANAGEMENT

BUREAU OF GEOLOGY

TALLAHASSEE

1980

INTRODUCTION

Development of guidelines for wise management of Florida's natural resources depends upon a good working knowledge of the State's geology as it relates to man's environmental problems. Management decisions must be based upon adequate geologic data for such fields as waste disposal, water resources management, land management, highway construction, geologic hazards, soils mapping, mining and reclamation. Environmental geologic maps provide the basic data needed for the creation and execution of sound programs in the above-mentioned fields. It is hoped that this map will not only serve the purpose for which it is intended but will also serve as a base map for future presentation of geologically related data of a more specialized or local nature. The ultimate purpose of the State's environmental geology mapping program is to insure development of Florida's natural resources with the least possible environmental damage.

This map presents geologic data in such a way that it can be understood by persons not specially trained in the science of geology. Common rock types are shown as they occur from just below the soil zone to depths of expected use for most purposes. Mapping involved aerial photographic and topographic interpretation and field work (visiting quarries, borrow pits, canals, road cuts and other rock exposures) to provide the necessary data points. Use was also made of all published and unpublished data in the files of the Florida Bureau of Geology plus published reports of the U.S. Geological Survey and the U.S. Soil Conservation Service.

REGIONAL SETTING

The physical character of the sediments in southwest Florida varies considerably near the surface. In general, the deposits dip to the south towards the South Florida Shelf (Applin and Applin, 1965). The near-surface deposits, less than 600 feet in depth, range in age from Eocene (up to 40 million years ago) to Recent. The lithology is variable with limestone, dolomite, shell, clayey sand, sand clay, quartz sand, and phosphorite all being present.

The two major physiographic divisions in the area are the Gulf Coastal Lowlands and the Central Highlands (White, 1970). Physiographic features associated with these two divisions are the Gulf Barrier Chain and Lagoons, the marine terraces, the DeSoto Plain, and the Polk Upland.

LOCATION AND EXTENT

The map area is bounded on the west and south by the Gulf of Mexico, on the north by the parallel of latitude 28 degrees North, and on the east by the meridian of longitude 82 degrees West. The counties that make up most of the area are Pinellas, Hillsborough, Manatee, and Sarasota. Counties with minimal land represented on the map are Polk, Hardee, DeSoto, Charlotte, and Lee. The major rivers are the Hillsborough, Alafia, Little Manatee, Manatee, Myakka, and Peace. Charlotte Harbor and Tampa Bay are two deep-water ports.

POPULATION AND DEVELOPMENT

The study area totals approximately 2,800 square miles with an average population density of 347 people per square mile. Most of the land, however, contains fewer residents than the average because the population is concentrated around the major cities and towns. The 1970 census shows the largest counties to be: Pinellas - 522,329; Hillsborough - 490,265; Manatee - 97,115; Sarasota - 120,413; and Charlotte - 27,559.

According to the 1970 census, Tampa was the largest city with a population of 277,767. St. Petersburg is the next largest city with a population of 216,232. Other metropolitan areas include: Clearwater - 52,074; Sarasota - 40,237; Pinellas Park - 22,287; Largo - 22,031; Bradenton - 21,040; Brandon - 12,749; Port Charlotte - 10,769; and Venice - 6,648.

The University of South Florida is the only state university with campuses in the map area. The main campus is located in Tampa and two other smaller campuses are located in St. Petersburg and Sarasota.

INDUSTRY AND TRANSPORTATION

The industry of this area is quite diversified; however, tourism, agriculture, and phosphate mining industries have the greatest impact on the economy. Shipping interests are another important industry with a very active port at Tampa. The retirement community is a significant contributor to the economy of the area, and large developmental tracts of land are common. Most of the coastal areas have been extensively drained by the building of canals.

The beautiful beaches and multitude of commercial attractions make this area of Florida very popular with vacationers. Busch Gardens in Tampa, and the Ringling Circus Museum in Sarasota, are two of the favorite stops for tourists. Deep sea fishing, sailing, golf, and swimming are only a few of the numerous activities available.

The major agricultural interest of the area is the citrus industry, but extensive land development has limited its economic contribution. All other forms of agriculture, such as cattle farming and poultry farming are also limited due to alternate land use.

Phosphate mining and processing is a major contributor to the economy of this area. The eastern edge of the map includes active mining areas that lie in the Central Florida Phosphate District. Limestone, shell material, sand, and clayey sand are also mined, with most of the material being used for construction purposes.

U.S. Highway 19 and U.S. Highway 41 are the major north-south routes on the map. Interstate 75, which is still under construction south of Bradenton, will be the major north-south route as soon as it is completed. There is also an extensive network of state and county roads criss-crossing the area.

Commercial air service is available in all of the major cities of the area. The largest and most modern airport is Tampa International. MacDill Air Force Base is the major military air facility, and it is located in Tampa. There are several smaller airports in the rural communities. Other modes of transportation include bus lines, railways, and ship lines.

CLIMATE

The average annual temperature for the area is approximately 73 degrees Fahrenheit (22 degrees Celsius), with July and August being the hottest months. The average annual precipitation is approximately 53 inches (135 cm), but differs markedly from year to year. The wettest months occur during the summer between June and September.

GEOLOGY

Surface deposits of southwest Florida are all of Tertiary age and range from unconsolidated sands to well-indurated limestones and dolomites. Six lithologic units are recognized in the area covered by the map for surface mapping and cross section construction. These units are limestone, limestone/dolomite, clayey sand, sandy clay, medium to fine sand and silt, and sand, shell and clay. The oldest rock outcroppings are the limestones occurring near Ballast Point and the Hillsborough River. Cooke and Mossom (1929) assigned these deposits to the Tampa Limestone of early Miocene age (approximately 25 million years old).

Limestone crops out or is relatively near the surface along the Hillsborough River and on the Interbay Peninsula in Tampa Bay. These limestones occur in the subsurface throughout much of the study area. They have been referred to by various geologists as the Tampa Formation, Tampa Group, Tampa Limestone, and St. Marks Formation. The Florida Bureau of Geology recognizes this unit as the downdip equivalent of the Chattahoochee Formation of North Florida and refers to it as the St. Marks Formation. This formation is characteristically a lime mud that is white to tan, sandy, microcrystalline, rarely phosphatic, with low to moderate intergranular, moldic, and vugular porosity. In many areas it is very fossiliferous and contains many varieties and large numbers of corals, echinoids, ostracods, foraminifers, and mollusks. The St. Marks Formation is underlain by the Suwannee Limestone of Oligocene Age. The Suwannee Limestone does not crop out within the map area, but is present in the subsurface. Characteristically, the Suwannee Limestone is much less sandy, more granular, and has a different faunal assemblage from the overlying St. Marks Formation. On the cross sections the basal limestone lithologies are associated with these two geologic formations. The tops of these beds dip to the south and are overlain by the Hawthorn Formation of Middle Miocene Age.

The limestone-dolomite lithology is exposed or is very near the surface along the Manatee River near Bradenton, and just east of Venice near the Myakka River. Within the map area this lithology is very sandy and phosphatic, and for any given locality the type of carbonate rock that is encountered will vary from a limestone to dolomite and will exhibit varying degrees of recrystallization. Deposits of this lithology are part of the Hawthorn Formation and, as shown on cross sections A-A' and B-B', this unit thickens to the south. The Hawthorn Formation exhibits a very diverse lithologic nature. It is composed of interbedded sandy clays, limestones, and dolomites, which are all intermixed with phosphate grains of varying sizes. In general, the lower part of the formation is much more calcareous than the upper section. In the subsurface, it is difficult to correlate the individual Hawthorn beds, but very sandy, phosphatic, and dolomitic limestones are predominant in the sequence.

The sandy clay lithology is recognized from well data to be near the surface just north of the Alafia River. In this area the sandy clay is very calcareous and forms the residuum over the St. Marks Formation. However, on cross sections A-A' and B-B', this lithology is part of the Hawthorn Formation and is sandy, phosphatic, dolomitic, and micritic. Lenses of sandy clay are interbedded with both the clayey sand and the limestone-dolomite lithologies.

The clayey sand lithology, as represented on the map and the cross sections, is referrable to the Bone Valley Formation. This formation is at or near the surface over most of the northeast quadrant of the map. The unit is very phosphatic and is normally found in association with sands, calcareous clays, and clays. The Bone Valley Formation and the phosphate deposits associated with it are largely thought to be derived from the reworking of the Hawthorn Formation during Pliocene time.

The sand, shell, and clay lithology occurs in the coastal segments of the map area and has not been found at elevations exceeding 25 feet. This lithology is quite variable, ranging from lithified coquinas to poorly indurated and semi-consolidated sand, shell, and clay beds. South of Sarasota, it is generally regarded as belonging to either the Caloosahatchee or Anastasia formations and being Pleistocene in age. North of Sarasota, this lithology is recognized as Pleistocene to Recent but no formal stratigraphic name has been given to it.

The medium to fine sand and silt unit, which covers almost the entire area, was only mapped where it consistently attained an appreciable thickness (at least 8-10 feet). The sands also contain minor amounts of heavy minerals, shell, phosphorite, and organics.

PHYSIOGRAPHY

The Florida Peninsula has been divided into three distinct physiographic zones by White (1970). These zones are the Northern or Proximal Zone, the Central or Mid-peninsular Zone, and the Southern or Distal Zone. The map area falls primarily into the Mid-peninsular Zone, with the extreme southern tip being near the Distal Zone boundary. Characteristically, the Central Zone is a series of ridges and valleys which runs parallel to the peninsula coastline. The map area lies to the west of the dominant ridges and valleys and is characterized more by broad uplands and marine terrace features.

The surface topography of the map area is directly related to ancient stands of the sea that repeatedly covered this area and then retreated, exposing it to erosion. Broad marine terraces, characterized by such geomorphic features as the DeSoto Plain, Polk Upland, and the Gulf Coastal Lowlands, were formed when the seas became more stationary during interglacial episodes. Healy (1975) showed several marine terraces that are possibly present in the map area. These terraces are the Silver Bluff (10'), Pamlico (8'-25'), Talbot (25'-42'), Penholoway (42'-70'), Wicomico (70'-100'), and Okeefenokee (100'-170'). The Silver Bluff terrace is only recognized in the area surrounding Charlotte Harbor.

Between the Alafia and Little Manatee rivers, elevations decrease rapidly in only a few miles and are in the form of a series of ridges. White (1970) refers to this region as "...one of the most conspicuously terraced parts of the Coastal Plain showing four flats and three intervening scarps." The elevations of the flat ridges are consistent with other Pamlico, Wicomico, and Okeefenokee terraces in the state.

The Gulf Barrier Chain forms most of the present day coastline. It is broken by tidal inlets, major estuaries, and segments where the barrier has joined the mainland. The Gulf Barrier Chain extends from Anclote Key on the north to Naples on the south. White (1970) points out that most of the sand in these barrier islands was locally derived by erosion of the headlands. This is exemplified by the more sandy nature of the barriers north of Tampa Bay. Elevations on the barrier chain rarely exceed 10 feet above mean sea level. As a result of the dominant on-shore winds, medium to fine sand and silt has built up on the seaward sides of the barrier islands. The sand may contain accessory materials, such as heavy minerals, phosphorite, shell material, and organics. South of Tampa Bay, the sand, shell and clay content of the Barrier Chain increases lagoonward and only the Gulf-facing side has relatively thick sequences of sand. The Gulf beaches south of Sarasota, especially around Venice, contain an appreciable amount of phosphorite in variable sizes ranging up to gravels. Abundant phosphatized fossils, such as shark teeth, ray plates, and mollusk fragments can be found on the beaches after storms or rough seas.

The Gulf Coastal Lagoons form the boundary between the Gulf Barrier Chain and the Gulf Coastal Lowlands. The lagoons generally widen toward their mouths and narrow toward their headlands. North of Tampa Bay, the lagoons are bounded by the medium to fine sand and silt lithology and south of Tampa Bay by the sand, shell, and clay lithology.

The Gulf Coastal Lowlands physiographic province occupies the area between the Gulf Coastal Lagoons and a prominent scarp that rises relatively steeply above the 40 foot elevation contour line. This scarp marks the boundary of the Gulf Coastal Lowlands with the DeSoto Plain. The Gulf Coastal Lowlands are a very gently sloping plain with a wide variation of surface lithologies. The medium to fine sand and silt become increasingly thicker above the 25 foot elevation contour. The sand, shell, and clay lithology predominates below the 25 foot elevation contour, except in a few areas where the older Hawthorn or St. Marks formations are near the surface.

A portion of two broad regional landforms, known as the Polk Upland and DeSoto Plain, occur within the map boundary. The Polk Upland is well over 100 feet in elevation and the DeSoto Plain does not exceed 100 feet. The Polk Upland borders the Gulf Coastal Lowlands in most of Hillsborough County in the previously described conspicuously terraced region. The DeSoto Plain borders the Polk Upland throughout the remainder of the map area with the boundary being approximately at the 90 foot contour. The Polk Upland is roughly consistent with the clayey sand lithology, and the DeSoto Plain with the medium to fine sand and silt lithology.

GROUND WATER

Ground water is the subsurface water in the zone of saturation; the zone in which all interstitial spaces are filled with water. Once water has infiltrated into the zone of saturation, it moves laterally under the influence of gravity toward places of discharge, such as springs, wells, streams, lakes, or the ocean. The geologic units which allow the storage and movement of subsurface water are called aquifers and are defined as zones below the surface that will yield water to wells in sufficient quantity to be economically important. The two major types of aquifers are unconfined aquifers, which are in direct contact vertically with the atmosphere through open pore spaces, and confined aquifers, which are separated from the atmosphere by relatively impermeable strata. Another type of aquifer of less extent is a perched aquifer, which is an isolated unit containing ground water whose position is governed by stratigraphy or structure.

The Floridan Aquifer is the principal water-bearing unit in the map area and exhibits characteristics of both confined and unconfined aquifers. The Floridan Aquifer in the map area is composed of a thick sequence of limestones and dolomites of Tertiary age. The majority of the potable water is contained in the upper portion of the aquifer, which consists of the Suwannee Limestone and the St. Marks Formation. Shallow artesian aquifers occur locally within the Hawthorn and the younger sand, shell, and clay beds. Less permeable limestones, dolomites, and clay units within the Hawthorn Formaton confine the Floridan Aquifer and artesian conditions are common over much of the area. The quality of water within the Floridan Aquifer generally decreases with depth and towards the coast. The Floridan receives recharge from localized rainfall where it is at or near the surface. It also is recharged from overlying secondary aquifers, sinkholes, lakes, and streams where impermeable sediments supporting these features have been breached allowing downward percolation of water. Ground water is discharged from the Floridan Aquifer by springs, municipal and private wells, seepage into rivers and the Gulf of Mexico, and upward movement into secondary aquifers.

Shallow artesian aquifers occur within the Hawthorn and younger deposits in the form of thin discontinuous limestone, dolomite, sand, and shell beds which are surrounded by relatively impermeable material. The amount of water which can be pumped from these shallow artesian aquifers is usually much less than from the Floridan, but is enough for some small domestic supplies. The water quality of these aquifers is also inferior to the Floridan as they contain more dissolved solids.

Water table aquifers occur in the surficial sand deposits and are widespread in the map area. These aquifers receive recharge almost entirely from rainfall and to a lesser degree by upward percolation from underlying aquifers. Water is discharged by seepage into lakes, streams, wells, underlying aquifers, and into the atmosphere by evapo-transpiration.

ECONOMIC GEOLOGY

Southwest Florida is rich in mineral reserves. Phosphate is abundant and relatively near the surface over much of the area. Limestone, dolomite, shell, sand, and clayey sand are also available in large quantities.

Phosphate is the most economically important mineral in southwest Florida. The eastern portion of the map area north of Sarasota County is within the boundaries of the Central Florida Phosphate District. The pebble phosphate is found within the clayey sands of the Bone Valley and Hawthorn formations. The phosphate ore is mined by the use of draglines with 30 to 60 cubic yard buckets. After the overburden is removed, the ore is mined, slurried and pumped to a plant for beneficiation. Florida produced approximately 40 million metric tons of beneficiated phosphate rock in 1977.

Limestone and dolomite have been quarried on a small scale in areas where the Hawthorn Formation is near the surface, such as around Bradenton. The rock is sandy, phosphatic, and well indurated. It is used for roadbase material, agricultural soil conditioners, and as aggregate in concrete.

Peat deposits are present in the Mango-Seffner area. These deposits are not widespread and tend to be very sandy.

Shell, coquina, and sand are mined locally and used for roadbase and fill material. Borrow pits are common throughout the map area.

OUTCROPS OF INTEREST

1. Charlotte County, Township 40S, Range 21E, Section 23. Borrow pit for sand and shell. Exposures of sand, shell, and clay with numerous mollusks, corals, and other marine fossils present.
2. Manatee County, Township 34S, Range 17E, Section 13. Abandoned dolomite quarry on the Manatee River. Exposure of a phosphatic, silty, dolomite that is typical of the Hawthorn Formation.
3. Manatee County, Township 35S, Range 19E, Section 16. Active sand and shell pit. Shell marl covered by an average of 12 feet of medium to fine sand and silt. Many large pectens present.

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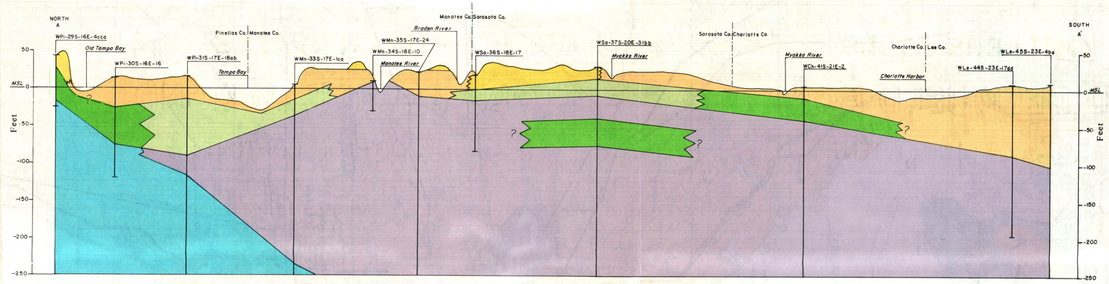

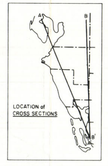

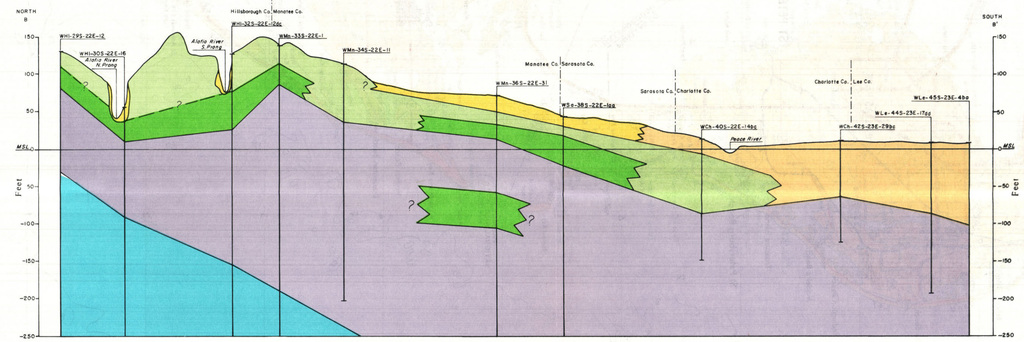

EXPLANATION

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