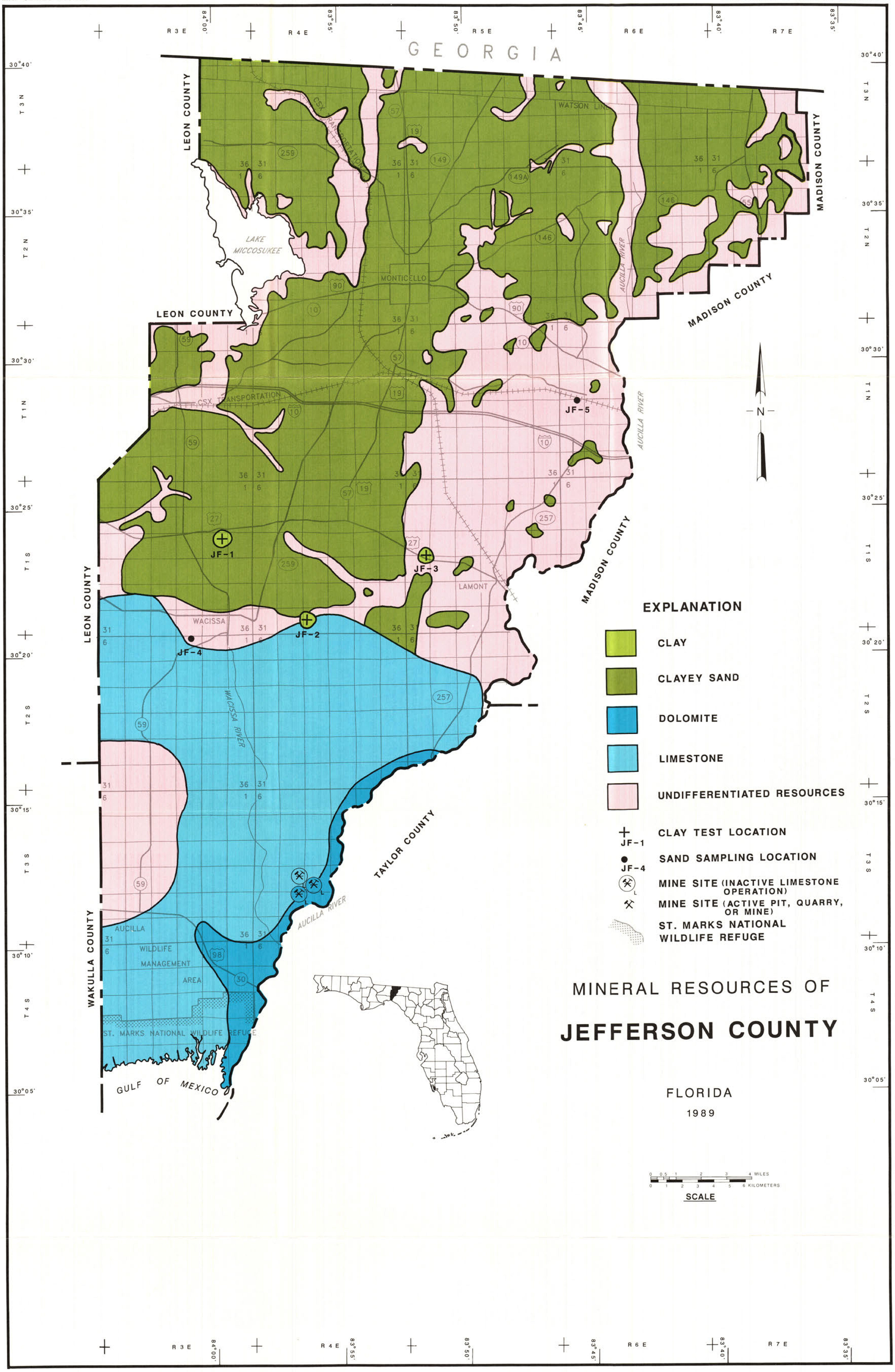
MAP SERIES NO. 129

FLORIDA GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES



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MINERAL RESOURCES OF JEFFERSON COUNTY, FLORIDA

BY

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JEFFERSON COUNTY

INTRODUCTION

In recent years, Florida's population has increased dramatically. This population growth has been accompanied by extensive development. Development, by its very nature, may render important mineral resources inaccessable to mining even though those resources are essential to the various activities that accompany growth. The industries associated with the utilization of mineral resources have a positive impact on Florida's economy. Extraction, transportation and distribution of mineral resources generate employment for the state's citizens and are a source of revenue for state and local government.

Utilization and conservation of mineral resources may be in conflict with the goals and projects that arise from rapid population growth. In 1985 and 1986, the Florida Legislature enacted legislation which requires each county to establish a comprehensive land use plan with certain deadlines. These land use plans should serve to reconcile the pressures of population growth with wise utilization of essential mineral resources. The information provided here may also be applied to problems involving zoning, road construction and waste disposal site location.

As a response to this act and at the request of the Apalachee Planning Council, the Florida Geological Survey initiated a study of the mineral resources of Jefferson County. The results of the study are presented as a map with an accompanying text written for use by state and local planners.

At present there is no commercial production of mineral commodities in Jefferson County. The general assessment of mineral resource potential presented here is not site specific.

Resource evaluation for this report is based on a number of sources including Florida Geological Survey reports and unpublished data, field reconnaissance, state and federal statistical data, and state and federal officials. The diversity of sources as well as their close association with the various aspects of resource evaluation lend substantial confidence to the general assessments and inferences of this report.

METRIC CONVERSION FACTORS

In order to prevent the awkward duplication of English and metric units in this report the following conversion factors are provided.

MULTIPLY	BY	TO OBTAIN
feet	0.3048	meters
miles	1.609	kilometers

GEOMORPHOLOGY

White, Vernon and Puri (in Puri and Vernon, 1964) divided the state into a number of general regions. Jefferson County includes three of these regions: the Northern Highlands, the Gulf Coastal Lowlands and the Coastal Swamps. Calico Hill, a minor feature superimposed on the Gulf Coastal Lowlands of Jefferson County is mapped by White, Vernon and Puri (in Puri and Vernon, 1964) but is not discussed in their work. Yon (1966) completed a detailed study of Jefferson County in which he described landforms which are locally superimposed on the regionally extensive features proposed by White, Puri and Vernon.

The Cody Escarpment separates the Northern Highlands from the Gulf Coastal Lowlands in Jefferson County (Figure 1). The Northern Highlands is a series of gently sloping, well drained plateaus which have been dissected by dendritic streams. This geomorphic region extends north into Georgia and Alabama. The Cody Escarpment, which is considered to be one of the most persistent topographic breaks in Florida, extends east from the Apalachicola River Valley to central Putnam County and is locally breached by the valleys of major streams.

The Northern Highlands have been locally subdivided; in the region that includes Jefferson County they are represented by the Tallahassee Hills. The Tallahassee Hills have been extensively dissected by stream erosion and subsurface dissolution of underlying limestone (Yon, 1966). They are characterized by relief ranging from less than 50 feet to approximately 100 feet with elevations locally of approximately 160 feet above mean sea level (MSL). In Jefferson County, the Tallahassee Hills are characteristically interspersed with lakes, ponds and numerous small streams. The Tallahassee Hills of eastern Jefferson County in the vicinity of the Aucilla River are characterized by numerous wetland areas. Hills in this area are isolated and relief is somewhat lower than relief noted in western Jefferson County (Yon, 1966). The area of Jefferson County, which is characterized by the Tallahassee Hills, is underlain mainly by the Pliocene Series (COSUNA chart, Gulf Coast Section, Braunstein et al., 1988), Miccosukee Formation (Hendry and Yon, 1967).

The Gulf Coastal Lowlands are bounded to the north in Jefferson County by the Cody Escarpment. They are low in elevation, poorly drained and extend south to the Gulf of Mexico. In Jefferson County, this geomorphic region is occupied by the extension of the Woodville Karst Plain from Leon and Wakulla Counties (Yon, 1966) (Figure 1). The Woodville Karst Plain (Hendry and Sproul, 1966) is a low, gently sloping plain characterized by dune sands lying on a limestone surface. The porous dune sands have allowed water to percolate downward, causing dissolution in underlying limestones. Collapse of these limestones has resulted in the development of shallow sinkholes (Yon, 1966).

The coastline is marshy and irregular without sand beaches or barrier islands. It is placed into the Coastal Swamps region by White, Puri and Vernon (Puri and Vernon, 1964). The absence of beaches and barriers is due to the shallow offshore slope which results in a lack of wave activity and an insufficient sand supply.

Virtually all of the valleys in Jefferson County are associated with rivers which flow through the county and may be classified as river valley lowlands (Yon, 1966). Although a number of streams originate in Jefferson County or flow through it, the three major ones are the Aucilla, Wacissa and St. Marks Rivers (Mineral Resources Map).

Healy (1975) mapped four marine terraces in the Tallahassee Hills of Jefferson County (Figure 2). These terraces include the Hazlehurst Terrace (215-320 feet MSL), the Coharie Terrace (170-215 feet MSL), the Sunderland Terrace (100-170 feet MSL), and the Wicomico Terrace (70-100 feet MSL) (Figure 2). Healy mapped these four terraces in Jefferson County on the basis of contour elevations and topographic expression of land forms. A more detailed study (Yon, 1966), which considered bedrock and covering sediments in addition to topographic elevations and expression, did not recognize marine terraces in the Tallahassee Hills of Jefferson County. Thus, the Hazlehurst, Coharie, and Sunderland Terraces probably represent elevation zones, as opposed to true marine terraces and will not be discussed further in this report.

The three marine terraces superimposed on the Gulf Coastal Lowlands of Jefferson County are discussed by Yon (1966) and Healy (1975), who also provide summaries of the historical development of the terrace nomenclature pertinent to Jefferson County. Reference should be made to those publications for additional information.

The Wicomico Terrace (70-100 feet MSL) in Jefferson County (Yon, 1966) is bounded to the north by the Cody Scarp and includes the area between the northern bounding scarp of the Pamlico Terrace and the Cody Scarp. Healy (1975) extends this terrace into the Northern Highlands based on elevation. Sediments associated with the Wicomico Terrace include sand and clayey sand which are deposited almost entirely on Suwannee Limestone (Yon, 1966).

The Pamlico Terrace in Jefferson County extends from the 10-foot contour (the elevation of the base of the small scarp which marks the landward limit of the Silver Bluff Terrace) inland approximately eight miles (Yon, 1966). The northern boundary of the Pamlico Terrace in Jefferson County is marked by a scarp, which has its toe at an elevation ranging from 26 to 30 feet, and exhibits eight to ten feet of relief. The Pamlico Terrace in Jefferson County is a limestone plain which is covered by varying thicknesses of sand and clay. The surface is well drained in eastern Jefferson County but is poorly drained with swamp development to the west (Yon, 1966). Calico Hill is described by Yon (1966) as a sand ridge with approximately 12 feet of relief oriented parallel to the Wacissa River and may represent a Pamlico dune.

The Silver Bluff Terrace, the youngest and lowest coastal terrace, extends from the coast to the 10-foot contour line which marks the base of the small scarp (Yon, 1966). Adjacent to the present coastline the Silver Bluff Terrace is characterized by coastal marshlands developed on the underlying Suwannee Limestone.

GEOLOGY

The rocks and sediments that underlie Jefferson County range in age from Mesozoic to Recent. To date, the deepest penetration of subsurface sediments in the county occurred at a depth of 7,909 feet (MSL). These sediments, obtained from an oil well (W-1854, section 1, Township 2S, Range 3E), were identified as Triassic (?) diabase and related igneous rocks deposited approximately 210 million years ago (Applin, 1951; Arthur, 1988).

Thousands of feet of Mesozoic Era siliciclastics and carbonates (limestones and dolomites) are overlain by carbonates and near-surface siliciclastic sediments including sand, silt, and clay that were deposited during the Cenozoic Era. Figure 3a shows the location of shallow geologic cross sections used in this report.

The oldest exposed unit in Jefferson County is the Suwannee Limestone, deposited 24 to 37 million years before present (B.P.), during the Oligocene Epoch. It crops out extensively (although locally covered by a veneer of Pleistocene sands) south of Wacissa in southern Jefferson County (Yon, 1966) and limited data suggests its thickness ranges from 150 - 180 feet (Figure 3b). Lithologically it is a pale orange, finely crystalline, fossiliferous limestone. Locally, the Suwannee Limestone may be silicified or dolomitized (Yon, 1966).

The Miocene age St. Marks Formation lies above the Suwannee Limestone in much of Jefferson County, although locally it is absent (Yon, 1966). In Jefferson County, it is a white to very pale orange, finely crystalline, sandy, silty, clayey limestone. Its major outcrop areas occur in southern Jefferson County. The St. Marks Formation may be silicified or dolomitized in outcrop as well as in the subsurface (Yon, 1966). It ranges in thickness from approximately 20-110 feet (Figure 3c).

In Jefferson County, the Miocene age, 15 to 23 million years B.P., Hawthorn Group overlies the St.Marks Formation and, locally, the Suwannee Limestone where the St. Marks is absent. Lithologically, the sediments of the Hawthorn Group in Jefferson County consists of pale olive, light greenish-gray, yellowish-gray, light gray, and moderate yellow, sandy, waxey, phosphatic clay. The clay is interbedded with very fine to medium, clayey quartz sands that contain phosphate. The clays and sands are frequently cherty and often associated with stringers of sandy calcilutites. The Hawthorn Group usually ranges in thickness from approximately 50 to 70 feet, although, in eastern Jefferson County Yon (1966) noted that this unit locally attains thicknesses of approximately 240 feet.

The Miccosukee Formation, which lies above the Hawthorn Group in Jefferson County, was considered by Hendry and Yon (1966) to be Late Miocene in age. As more data has become available, recent workers have assigned the Miccosukee Formation to the Pliocene (COSUNA Chart, Gulf Coast Section, Braunstein et al., 1988). Locally, the Miccosukee lies above the St. Marks Formation or the Hawthorn Group. Lithologically the Miccosukee Formation is an assemblage of lenticular clayey sands and clay beds which are laterally discontinuous (Yon, 1966). Generally, the Miccosukee Formation is a moderately to poorly sorted, coarse to fine grained, variably colored, clayey quartz sand. The thickness of the Miccosukee Formation in Jefferson County is irregular but ranges up to 160 feet in thickness (Yon, 1966). These distinctive sediments can be observed along numerous road cuts throughout the northern half of the county.

Variable thicknesses of Pleistocene, 2.8 million to 0.1 million years B.P., clayey quartz sand overlie the St. Marks Formation and the Suwannee Limestone in southern Jefferson County and the Miccosukee Formation northwest of Wacissa. Younger Holocene, 0.1 million years B.P., deposits consisting of reworked Pleistocene sand and quartz sand derived from the Miccosukee Formation occur along stream valleys (Yon, 1966).

MINERAL RESOURCES

The intent of this discussion is to provide information on the distribution of various mineral resources in Jefferson County. It will also present the results of tests applied to specific samples from the county. These tests were carried out to define properties of a sample related to its potential industrial uses. The data presented here are from scattered locations and are intended, where favorable, to provide a basis for further investigation.

The mineral commodities, which are discussed here, include limestone, dolomite, clay, clayey sand and peat. It is essential to note that many factors must be considered before a commodity is actually mined. These include the quality or purity of a mineral deposit, the amount of material ultimately available for mining and the thickness of overlying but unusable material (overburden) as well as transportation costs and distance to market.

Occasional variations between the geologic cross-sections and the mineral resources map may occur. The mineral resources map is designed as an overview of mineral resources in Jefferson County. The geologic cross-sections are included to provide information on the distribution of lithologies from the surface to depths for which data is generally available. This report is intended to document the general distribution of potential mineral resources.

Limestone

Limestone is a sedimentary rock composed mainly of the mineral calcite (calcium carbonate) with the chemical formula $CaCO_3$. Yon (1966) noted that the Suwannee Limestone of Oligocene age is the most important potential source of limestone in Jefferson County. The limestone shown on the mineral resources map accompanying this report is almost entirely Suwannee Limestone, which contains in excess of 95 percent calcium carbonate. The thickness of overburden should not inhibit mining in most areas as the Suwannee Limestone lies within approximately 20 feet of the surface from just south of the town of Wacissa to the coast and, in most areas, is covered by 10 feet or less of overburden as shown on the geologic map of Jefferson County (Yon, 1966).

There is no current commercial production of limestone in Jefferson County and the limestones of the county were rated in a statewide report on mineral resources as having low potential for development (Schmidt, et al., 1979). This rating was based on the fact that even though limestone is present in southern Jefferson County (Knapp, 1978; Schmidt, 1979), it has not been proven economic. Yon (1966), however, noted that in 1964 limestone was mined by the county road department and Buckeye Cellulose Company for roadbase in the southern part of the county. Yon (1966) suggested that the Suwannee Limestone might potentially be used as roadbase course material, agricultural limestone, or quick and hydrated lime.

Dolomite

Dolomite is a sedimentary rock containing more than 50 percent of the mineral calcite and dolomite, in which dolomite is the most abundant (Schmidt, et al., 1979). Although not currently being mined, the distribution of dolomite in Jefferson County is shown on the Mineral Resources Map. Yon (1966) noted that the dolomite in Jefferson County is primarily located along the Aucilla River. The thickness of the dolomite has not been determined. Schmidt et al. (1979) classify an area in southernmost Jefferson County as having low potential for the development of dolomite. "Low potential" in this report indicates that although some dolomite is present it has not been proven economic.

Clay

Clay has not been mined in Jefferson County to date. In Jefferson County, Yon (1966) reported that montmorillonites and kaolinites are associated with the Hawthorn Group, the Miccosukee Formation and the undifferentiated sediments of Pleistocene age. It is noted that some of the clays from the Miccosukee Formation have a very low sand content, which is favorable for commercial use. However, it is also noted that these clays generally occur in discontinuous lenticular deposits. Terrace deposits of southern Jefferson County contain sandy montmorillonitic clays.

Calver (1949) sampled clay sediments from a 9-1/2 foot test boring located one and one-half miles east of Wacissa (Jf-1, section 14, Township 1S, Range 3E). Tests indicated that it may be suitable for porous common brick (Table 1, Mineral Resources Map).

Yon (1966) arranged for seven clay samples from Jefferson County to be tested for various physical properties. Of seven samples tested, two samples were found to be suitable for making brick and one sample with the addition of alkali was possibly suitable for pottery or decorative tile (Jf-2, section 33ac, Township 1S, Range 4E, Table 2 and Jf-3, section 19bb, Township 1S, Range 5E, Table 3, Mineral Resources Map).

Clayey Sand

Sand deposits in Jefferson County are mainly associated with the Miccosukee Formation. The sand ranges in size from very fine to very coarse grained and is predominantly fine to medium grained. The Florida General Soils Atlas for Regional Planning Districts I and II assigns the Lakeland-Troup soil association to much of the area mapped as clayey sand on the Mineral Resources Map. The Lakeland-Troup association is further noted to be a good source of sand and is described as sandy throughout with "very thick sandy layers over loamy subsoils" (Florida Division of State Planning, 1974). This rating of "good" indicates that the soil generally contains a layer of sand at least three-feet thick which has its top within at least six-feet of the surface. It is noted, however, that the ratings do not consider location of the water table, quality or quantity of the deposit or other factors affecting mining.

Yon (1966) had divided the sands in Jefferson County into primary clayey quartz sands and secondary clayey quartz sands based on the relative purity of the sands. It must be noted, however, that sands examined in this area are generally mixed with clay and are iron stained so that the outlook for their commercial development is not good. Sand is not currently mined in Jefferson County.

Peat

Peat accumulates when plant material is deposited in a wet environment in which the action of decomposing organisms is inhibited (Bond, et al., 1986). Although peat is not currently mined in Jefferson County, the county has extensive wetlands. Davis (1949) in his comprehensive survey of Florida peatlands noted that there are a few small marshes which contain peat as well as some tyty and bay swamps which are characterized by peat accumulation. Jones et al., (1907) also noted the presence of organics underlying several small marshes. Peat is used extensively in a variety of horticultural and agricultural applications in Florida.

Undifferentiated Resources

Large areas of the county have surface and near-surface sediments comprised of sands, sandy clays, clay, marl, and organic muck. These undifferentiated resources are present throughout much of the northeastern and southwestern parts of Jefferson County.

The heterogeneous nature of these sediments would tend to preclude their large scale economic marketability. Two sites in this area were sampled for grain size analysis (JF-4 and JF-5, Mineral Resources Map). Results of these analyses are shown in Table 4. The values obtained indicate that the sands have no economic potential at this time. Locally, however, where costs are not prohibitive and the need is present for uses such as top soil or road fill, extraction is feasible. The possibility does exist that a future comprehensive investigation of these undifferentiated sediments may lead to economic or industrial applications.

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Table 1
Physical Properties of Wacissa Clay JF-1, Mineral Resources Map
(From Calver, 1949)

Plasticity, judged by feel....................Good
Water of plasticity....................31.01%
Linear air shrinkage....................8.6 %
Modulus of rupture, average.. 210.0 pounds per square inch.
Slaking test....................Fast
Color....................Brown

Fire Tests:

Temp. °F	Linear Sheer Per cent	Absorption Per cent	Porosity Per cent	Color
1742	1.0	14.9	34.8	Reddish Orange
1922	2.5	14.8	35.0	Reddish Orange
2102	2.0	14.1	34.0	Brick Red
2174	2.5	14.4	34.0	Brick Red
2246	2.5	13.6	32.5	Brick Red
2390	2.5	13.8	33.3	Brick Red

Table 2
Physical Properties for Clay JF-2, Mineral Resources Map
(From Yon, 1966)

Working characteristics....................short working, stick, plastic
Water of plasticity....................25.0 %
Drying shrinkage....................5.5 %
Dry strength....................Fair, warping

Slow Firing Test:

Temp. °F	Linear Shrinkage Per cent	Absorption Per cent	Hardness	Color
1800	5.5	16.4	Fair Hard	Light Brown
1900	5.5	18.9	Fair Hard	Light Brown
2000	5.5	20.4	Hard	Brown
2100	5.5	20.4	Hard	Chocolate
2200	4.0	20.0	Very Hard	Chocolate
2300	4.0	13.3	Very Hard	Chocolate

Table 3
Physical Properties for Clay JF-3, Mineral Resources Map
(From Yon, 1966)

Working characteristics....................long working, smooth, plastic
Water of plasticity....................26.0 %
Drying shrinkage....................5.5 %
Dry strength....................Fair, warping

Slow Firing Test:

Temp. °F	Linear Shrinkage Per cent	Absorption Per cent	Hardness	Color
1800	5.0	18.5	Fair Hard	Tan
1900	5.0	19.6	Fair Hard	Tan
2000	5.0	17.6	Hard	Tan
2100	6.0	17.0	Hard	Tan
2200	9.0	13.9	Very Hard	Buff Tan
2300	9.0	12.9	Steel Hard	Olive Tan

Potential use: light color, some cracking, shrinkage a little high, addition of alkali might make a pottery or decorative tile.

Table 4. Screen analyses of sand in Jefferson County, Florida.

Deposits			Laboratory Test Data Screen Analysis Sieve No. and Cumulative Weight Percent Retained						
Sample No.	Section Township, Range	Method of Sampling	4	8	16	30	50	100	Fineness Modulus*
Jf-4	sec 3bc T2S, R3E	Spot	6.73	8.12	10.81	19.21	43.38	100.0	1.88
Jf-5	sec 19bb T1N, R6E	Spot	0	0.27	0.85	6.94	33.09	100.0	1.41

*Fineness Modulus: A means of evaluating sand and gravel deposits which consists of sieving samples through a standard set of sieves, adding the cumulative weight percentages of the individual screens, dividing by 100, and comparing the resultant fineness modulus number to various specification requirements (Bates and Jackson, 1980).

The fineness modulus is an index of the fineness or coarseness of an aggregate, but gives no idea of grading. The higher the fineness modulus the coarser the aggregate (ASTM, 1987).

The method of sieve analysis presented here follows that outlined in ASTM 1987, v. 4.02, section C 136-84a. The reader is also referred to the Florida DOT Manual of Florida sampling and testing methods for aggregates, FDOT, designation FM 1-T 027.

The well and quarry system used in this report uses the rectangular system of section, township and range for identification. The well or outcrop number consists of six parts: W for well or L for quarry, county abreviation, the Township, Range, and Section, and the quarter/quarter location within the section.

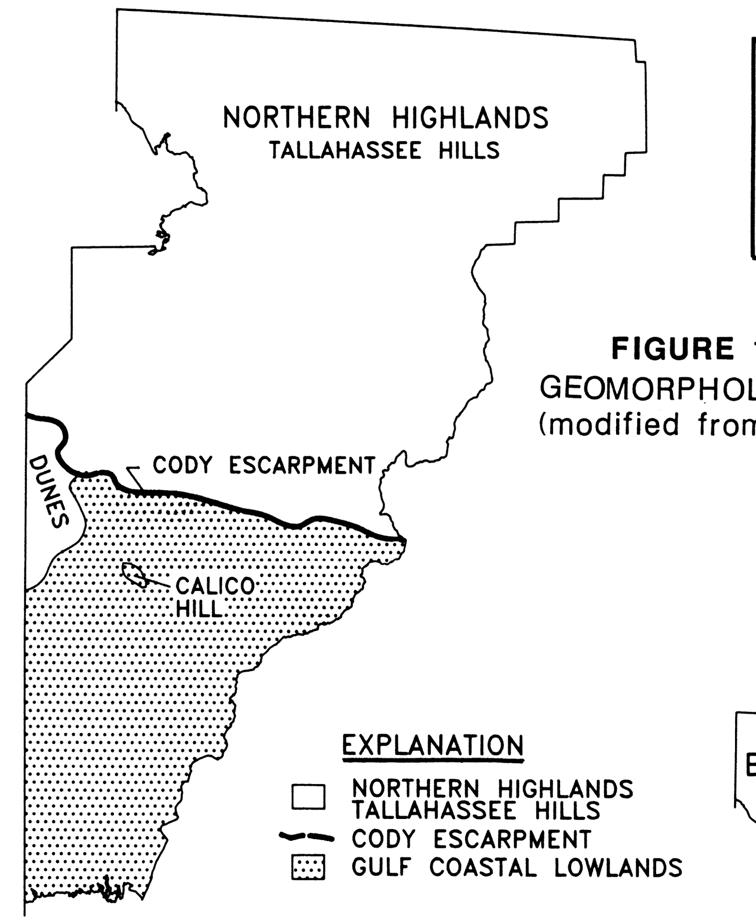
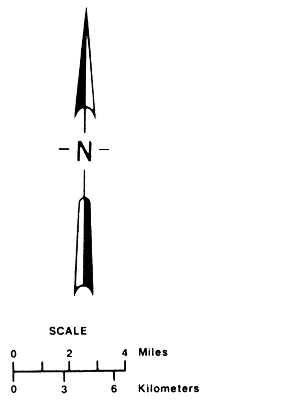


FIGURE 1
GEOMORPHOLOGY
(modified from White, 1970)



SCALE FOR FIGURES 1,2 AND 3a

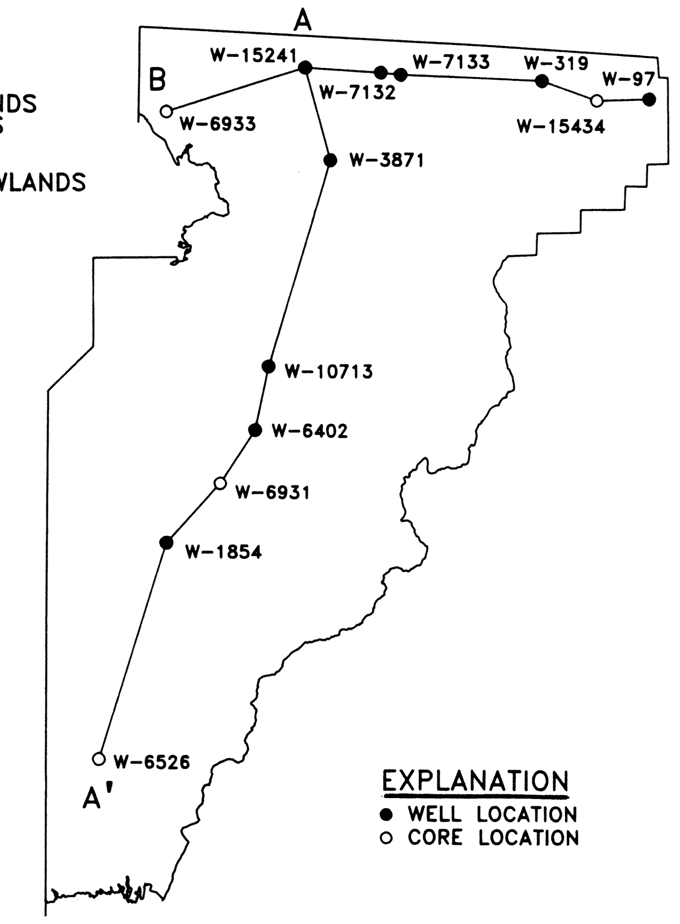


FIGURE 3a
CROSS SECTION LOCATIONS

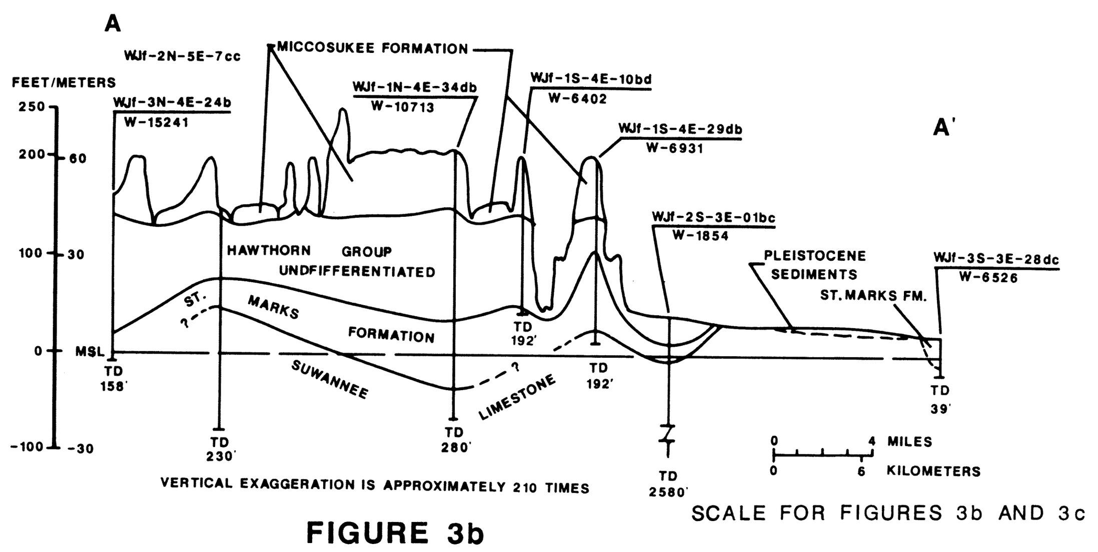
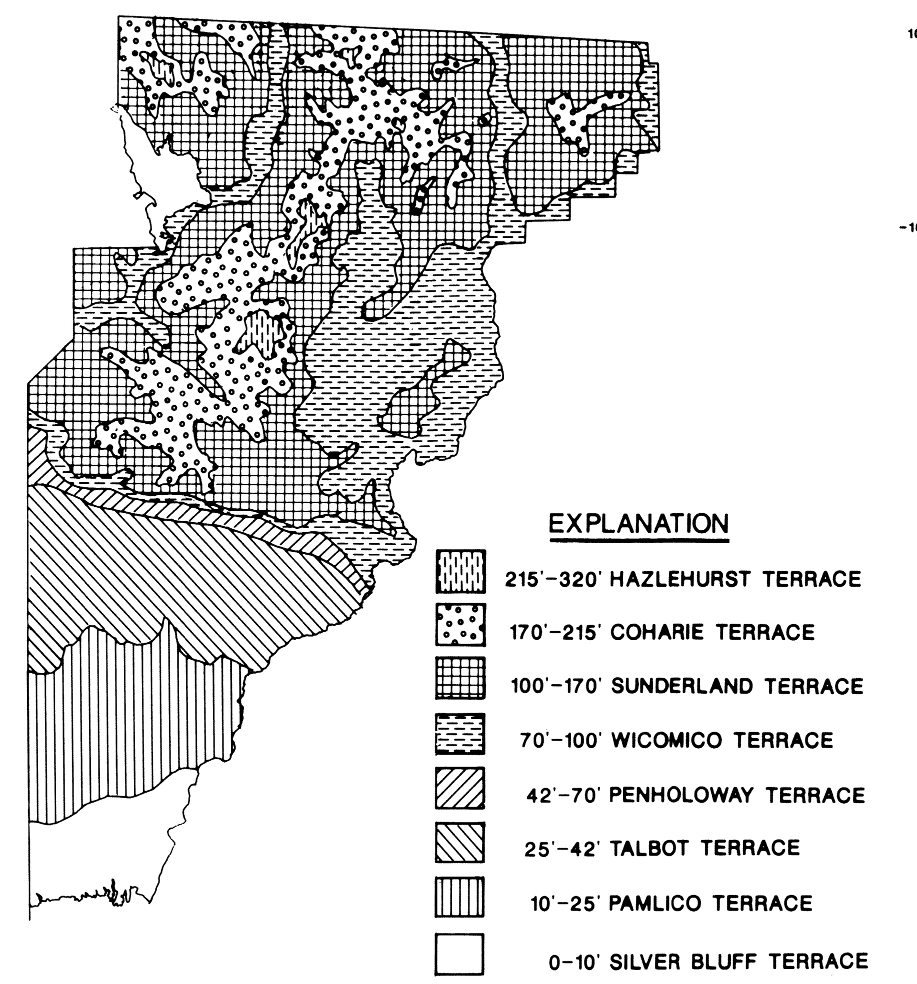


FIGURE 3b
CROSS SECTION A–A'



EXPLANATION

FIGURE 2
TERRACES AND SHORELINES
(modified from Healy, 1975)

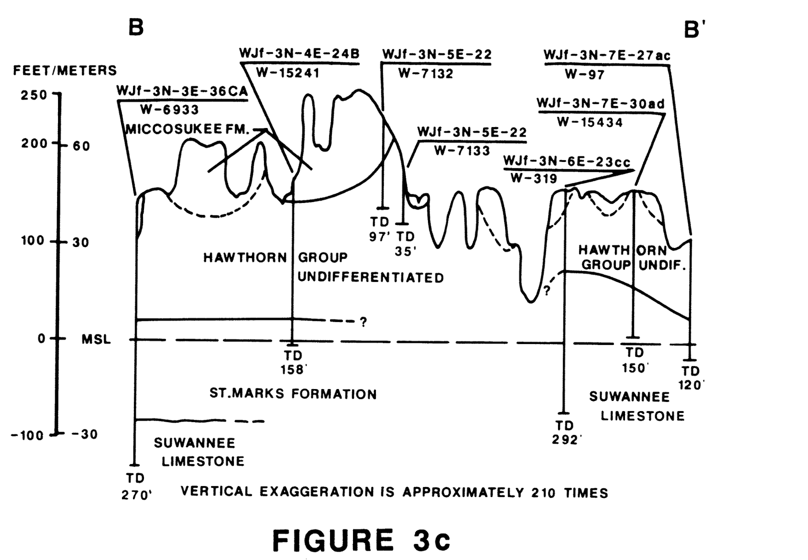


FIGURE 3c
CROSS SECTION B–B'