STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION
David B. Struhs, *Secretary*

DIVISION OF ADMINISTRATIVE AND TECHNICAL SERVICES

FLORIDA GEOLOGICAL SURVEY
Walter Schmidt, *State Geologist and Chief*

Open File Report No. 74

MINERAL RESOURCES OF JACKSON COUNTY, FLORIDA

By

Steven M. Spencer, P.G. #319 and Jacqueline M. Lloyd

Tallahassee, Florida
1999

ISSN 1058-1391

TABLE OF CONTENTS

ILLUSTRATIONS

TABLES

MINERAL RESOURCES OF JACKSON COUNTY, FLORIDA

By
Steven M. Spencer, P.G. #319 and Jacqueline M. Lloyd

INTRODUCTION

In recent years, considerable attention has focused on Florida's rapid development, the accompanying population increase, and their effect on the state's important mineral resources. Frequently, this development occurred in areas underlain by mineral deposits, precluding their extraction. The economics associated with these mineral resources represent substantial employment and income to the private sector as well as taxes to county and state governments. Furthermore, knowledge of mineral resource locations can aid land-use zoning decisions and assist in community environmental resource conservation.

In order to assist county officials, the Florida Geological Survey (FGS) initiated an investigation of Jackson County's mineral resources. The FGS communicated with the county's community development personnel to identify their information needs associated with mineral resources and to present the results of our research in an appropriate format. This mineral resource assessment is general and is intended as a land-use planning tool. Concerns about, or interest in, any specific sites would require detailed geological research beyond the scope of this investigation.

A knowledge of Jackson County's mineral resources is basic and integral to the process of initiating, developing, and implementing effective land use decisions. The information presented here will be useful to planners and officials in their analyses of urban and rural development in such areas as zoning, permitting, road construction, and the establishment of waste disposal sites.

Resource evaluation for this report is based on a number of sources including Florida Geological Survey reports and unpublished data, core and well cutting descriptions, geological logs, field reconnaissance, state and federal statistical data, company reports, questionnaires, and discussions with mining company personnel and state and federal officials. Although detailed information on company statistics is confidential, information of a more general nature is readily available or can be reasonably extrapolated from existing data.

Table 1. Metric Conversion Factors

For readers who prefer metric units to the U. S. units used in this report, the following conversion factors are provided.

MULTIPLY	BY	TO OBTAIN
pounds	0.4536	kilograms
square inches	6.452	square centimeters
feet	0.3048	meters
miles	1.609	kilometers
acres	0.4046	hectares
tons	907.18	kilograms

GEOMORPHOLOGY

Jackson County is located in the central portion of the Florida panhandle. It falls within White's (1970) Northern (Proximal) Zone. This zone is characterized by broad uplands (referred to as the Northern Highlands) that traverse most of northern Florida. More specifically, the Northern Highlands extend from Florida's east coast, westward to the Western Highlands of the panhandle. However, within the tri-county region of Holmes, Washington, and Jackson Counties, there is an area of lower elevations bisecting these broad uplands. White (1970) named this area the Marianna

Lowlands. This same area falls within Scott's (in preparation) Dougherty Karst Plain District. The eastern portion of the Marianna Lowlands, which lies within Jackson County, has been renamed the Marianna Karst Plain by Scott (in preparation).

In Jackson County the Marianna Karst Plain is bounded on the east by the Chattahoochee River. This karst plain extends westward to Holmes Creek, which forms the boundary between Jackson and Holmes Counties. Forming the southern boundary of the Marianna Karst Plain in Jackson County are Compass Lake Karst Hills and Sneads Hills (Scott, in preparation). These two areas correspond to White's (1970) New Hope Ridge and Grand Ridge, respectively, and are relics of the Northern Highlands. These two ridges are, in turn, bisected by the Chipola River and its valley (White, 1970), the remaining geomorphic subdivision present in the county (Figure 1). The Chipola River trends north to south following joint patterns in the limestone bedrock. Occasionally, it flows underground forming natural bridges such as those found at the Florida Caverns State Park.

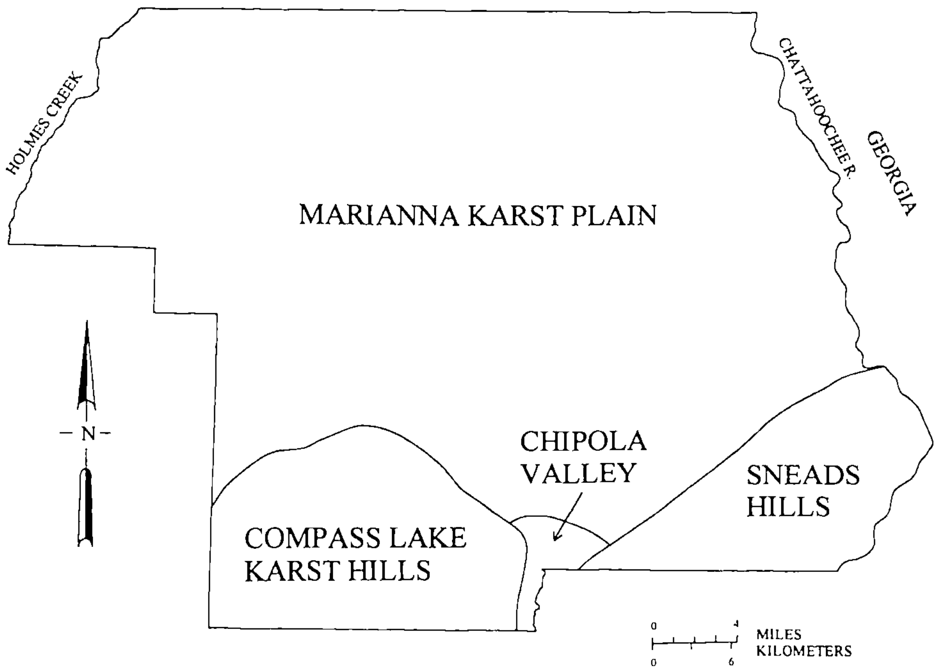

Figure 1. Geomorphology of Jackson County, Florida (after Scott, in preparation; and White, 1970).

Land surface elevations within the karst plain range from approximately 70 feet above mean sea level (MSL) along the Chipola River to approximately 130 feet (MSL). East-west topographic profiles in Jackson County show that elevations within the karst plain are approximately 10 to 15 feet higher west of the Chipola River than to the east. The toe of the north facing slope of the Compass Lake Karst Hills feature (New Hope Ridge) is approximately 140 feet above MSL. Elevations along the highest portions of this ridge are approximately 300 feet. In comparison, elevations along the top of Sneads Hills (Grand Ridge), which lie to the east of the Compass Lake Karst Hills, are generally lower. Here, an elevation of 280 feet above MSL is seldom exceeded except near Sneads, Florida, where the crest of one hill exceeds 300 feet in elevation. The toe of the Sneads Hills feature (Grand Ridge) is approximately 100 feet above MSL.

The tri-county region of Holmes, Washington and Jackson Counties, and extending north into Alabama, has experienced a significant amount of erosion throughout its past. The weathering and erosional processes of numerous streams and rivers, coupled with dissolution of the underlying limestone, have reduced land surface elevations to the point where, today, Eocene rocks crop out.

Younger sediments, which once covered the area are absent in many places. Underground drainage developed in some areas of Jackson County results in a distinctive karst landform. The karst is punctuated by numerous swales, small lakes, ponds, and streams. Additionally, there are a large number of dry and wet caves present throughout the Jackson County area, particularly in the vicinity of Marianna.

Healy (1975) recognized five marine terraces in Jackson County based strictly on elevation (Figure 2). These terrace plains, which are generally considered depositional features, formed during higher stands of sea level. The terraces, from highest to lowest, include the Hazlehurst Terrace (215 to 302 feet above MSL), the Coharie Terrace (170 to 215 feet above MSL), the Sunderland / Okefenokee Terrace (from 100 to 170 feet above MSL; Cooke, 1939/ MacNeil, 1950), the Wicomico Terrace (from 70 to 100 feet above MSL), and the Penholoway Terrace (from 42 to 70 feet above MSL).

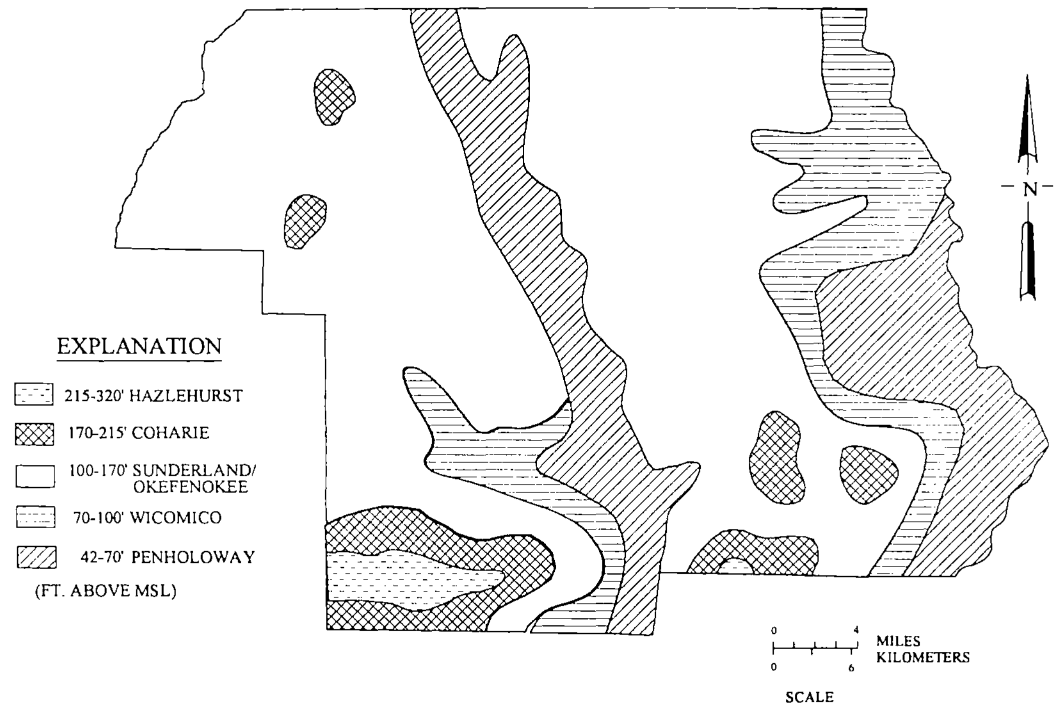

Figure 2. Terraces and Shorelines of Jackson County, Florida (modified from Healy, 1975).

In Jackson County, these terraces trend from south to north, with the higher elevations to the south and lower elevations to the north. The higher Hazlehurst Terrace coincides with the highest elevations in the county. Figure 2 shows the approximate location and areal extent of these terraces.

GEOLOGY

The rocks and sediments underlying Jackson County range in age from Paleozoic to Recent. To date, the deepest penetration of subsurface sediments in the county occurred at a depth of 9,117 feet below mean sea level (MSL) in an oil test well (W-1886, Section 8, Township 5 North, Range 11 West). These deep sediments were identified as Triassic (?) basalt sills intruding Paleozoic red and gray sandstones and shales (Applin, 1951; Lloyd, 1985; Arthur, 1988). These basement rocks are overlain by thousands of feet of Mesozoic and lower to middle Cenozoic Era siliciclastic and carbonate (limestones and dolostones) sediments. These sediments are overlain in the near-surface by late Cenozoic carbonate and siliciclastic deposits. Figures 3, 4, 5, and 6 show the location map and shallow geologic cross sections through these near-surface deposits.

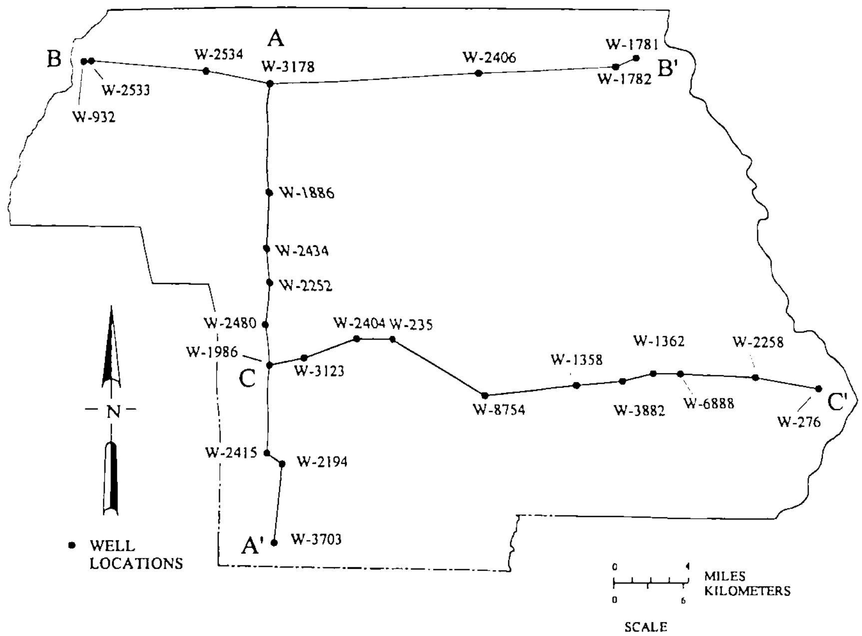

Figure 3. Geologic Cross Section Location Map

The Upper Eocene Ocala Limestone is the oldest unit that crops out in Jackson County (Hendry and Yon, 1958; Puri and Vernon, 1964; Schmidt and Coe, 1978; Scott, 1993). Anticipating the loss of outcrops due to the construction of Jim Woodruff dam, Hendry and Yon (1958) studied the area along and between the Chattahoochee and Flint Rivers in Jackson and Gadsden Counties, Florida and Seminole and Decatur Counties, Georgia. They identified outcrops of Ocala Limestone along both rivers, north of the dam, which were covered when the dam was completed. Exposures of Ocala Limestone are now found in the central portion of the northern half of Jackson County (Scott, 1993) and limited data suggest its thickness ranges from 100 to 200 feet (Figures 4 and 5). The Ocala is composed of a light yellow to cream to white colored, granular, permeable, and highly fossiliferous, pure limestone. Localized weathered surfaces are frequently hardened by recrystallization or silicification. Fossils include foraminifera, echinoids, mollusks, and bryozoans (Schmidt and Coe, 1978). The Ocala Limestone is unconformably underlain by the Middle Eocene Lisbon Formation in this area. The Lisbon Formation generally consists of fossiliferous limestones interbedded with argillaceous limestones and calcareous shales (Schmidt and Coe, 1978, Chen, 1965).

Two Oligocene formations, the Marianna Limestone and the Suwannee Limestone, overlie the Ocala Limestone in Jackson County. The Marianna lies directly on top of the Ocala. Schmidt and Coe (1978) found the Marianna Limestone to crop out along a narrow band through central Jackson County, south of the Ocala exposures and the Suwannee Limestone to crop out in another narrow band paralleling the Marianna outcrop belt to the north. Scott (1993) maps essentially the same area as undifferentiated Suwannee and Marianna Limestone. Scott (1993) also depicts these undifferentiated formations as cropping out along the Chipola River in the southern half of the county.

The Marianna consists of a light gray to cream to white massive limestone which is less permeable than the Suwannee and can be glauconitic (Moore, 1955). It has an abundant fauna of large foraminifera with locally common pectens and bryozoa (Schmidt and Coe, 1978) and ranges in thickness from approximately 25 to 85 feet (Figures 4 and 6). The overlying Suwannee Limestone consists of tan to buff colored, porous, fossiliferous limestones, dolomitic limestones, and dolomite (Schmidt and Coe, 1978) and ranges in thickness from approximately 25 to 110 feet (Figures 4 and 6).

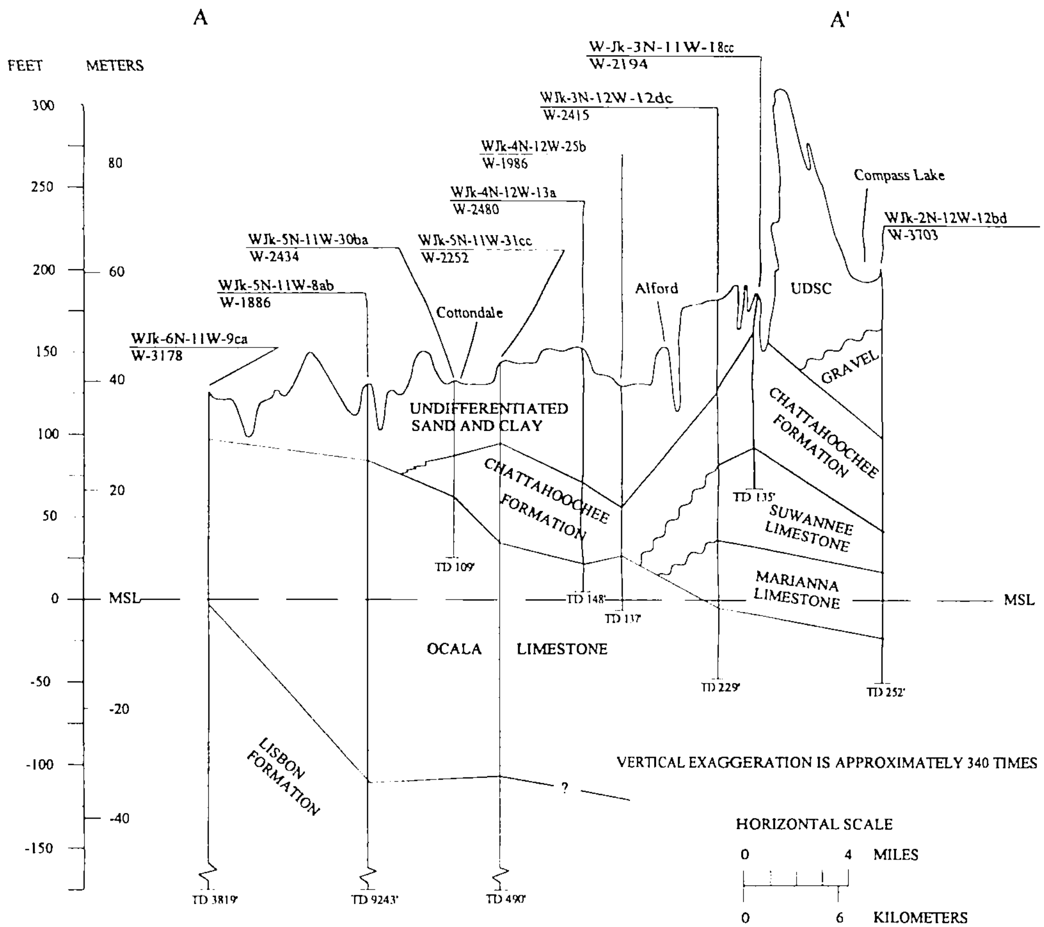

Figure 4. Geologic Cross Section A-A' (modified from Schmidt and Coe, 1978).

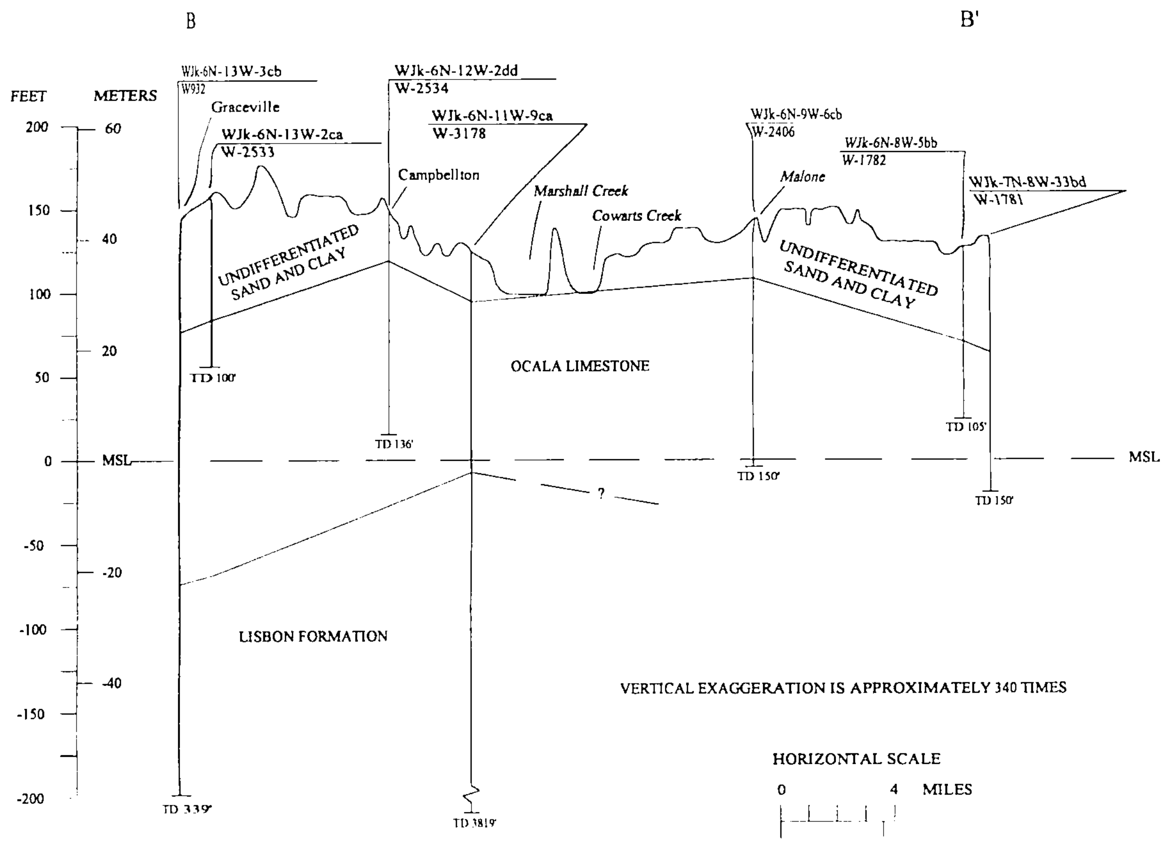

Figure 5. Geologic Cross Section B-B' (modified from Schmidt and Coe, 1978).

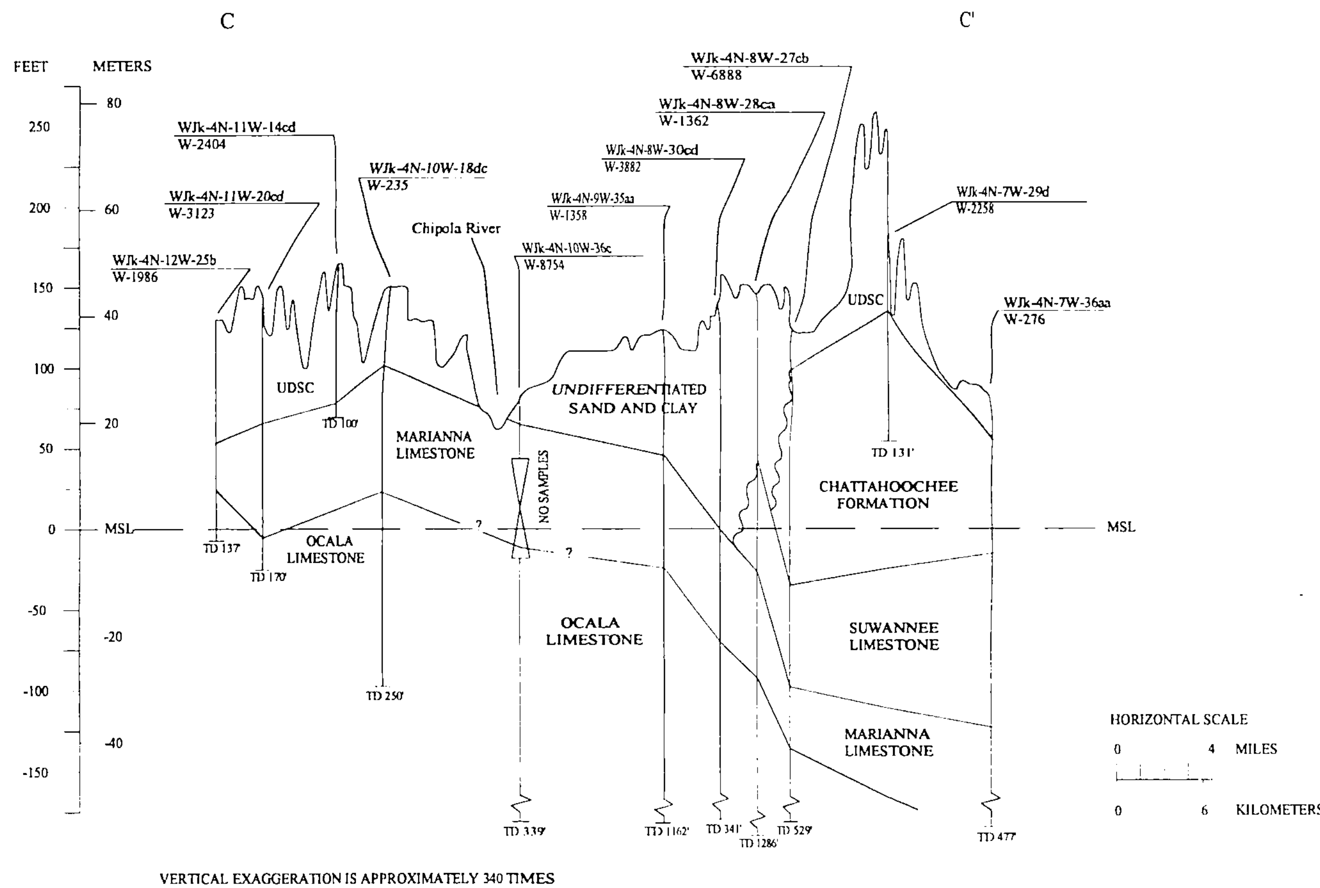

Figure 6. Geologic Cross Section C-C' (modified from Schmidt and Coe, 1978).

Schmidt and Coe (1978) use Puri's (1953) nomenclature for the Miocene Series in the Florida panhandle, which recognized three stages: the Tampa Stage, the oldest; the Alum Bluff Stage; and the Choctawhatchee Stage, the youngest. Puri and Vernon (1964) named the panhandle equivalent of the Tampa, the Chattahoochee Formation; this is the nomenclature used by the FGS. In Jackson County, the Chattahoochee Formation overlies the Suwannee Limestone and the Marianna Limestone, where the Suwannee is absent. Schmidt and Coe (1978) state that in Jackson County, this unit is characterized by fine quartz sand within an argillaceous limestone; Scott (1993) defines the Chattahoochee as fossiliferous, often moldic dolostones with subordinate limestones, clays and silts. Scott (1993) maps the surficial occurrence of the Chattahoochee Formation in the southeastern corner of Jackson County and in localized areas near the town of Marianna, in the center of the county. Limited data suggest that the thickness of the Chattahoochee Formation ranges from approximately 40 to 130 feet in Jackson County (Figures 4 and 6).

Although the Alum Bluff Stage (current FGS nomenclature uses Alum Bluff Group) was not differentiated by Schmidt and Coe (1978) in Jackson County, Scott (1993) mapped an extensive area of Alum Bluff Group in western Jackson County. Scott (1993) describes the Alum Bluff Group as clays, silts and sands, often greenish to gray in color, sometimes containing shells. Schmidt and Coe (1978) point out that the Alum Bluff and overlying Choctawhatchee are very similar in lithology and, upon weathering, are almost impossible to separate. In fact, the Choctawhatchee Stage (current FGS nomenclature uses Choctawhatchee Formation) was not differentiated by either Schmidt and Coe (1978) or Scott (1993) in Jackson County and there are insufficient data to estimate the thickness of either of these two units in Jackson County. These units are included in the "undifferentiated sand and clay" in the cross sections in this report.

The Upper Pliocene to Pleistocene Citronelle Formation overlies the Alum Bluff Group and was recognized by Scott (1993) to crop out in southwestern Jackson County and in a very limited area in southeastern Jackson County. The Citronelle contains fine to coarse grained sands with gravel, silt and clay and is often oxidized to reddish hues in exposures (Scott, 1993). Very limited FGS data indicate that the Citronelle may range from approximately 10 to 40 feet thick in this area. The Citronelle is generally not differentiated in the FGS well data base and is therefore included in the "undifferentiated sand and clay" in the cross sections in this report.

Overlying these units, throughout the county, is a blanket of undifferentiated Pleistocene to Holocene sand, clay, gravel, sandy clay, and clayey sand (Figures 4, 5, and 6). The thickness of these undifferentiated sediments ranges from approximately 20 to 140 feet. In addition, most of the river and stream valleys have an accumulation of clean Holocene sand due to recent erosion and reworking (Schmidt and Coe, 1978).

MINERAL RESOURCES

Introduction

The purpose of the following discussion is to provide information on the occurrence of potential economic mineral commodities in Jackson County. The information presented here is not intended to be an exhaustive investigation leading to industrial development. However, where the information is favorable, it may show that certain areas warrant further investigation. The mineral resources map (Figure 7) is designed to present a geographic overview of the major economic mineral commodities identified in Jackson County. Factors such as thickness of overburden, quality and volume of the deposit affect the mining of the mineral commodity at any specific site. Geologic cross sections were extrapolated from cores, well cuttings, and geophysical logs to show the distribution and thickness of Eocene and younger stratigraphic units (cross sections A-A' through C-C', Figures 4 to 6). As a result, occasional variations between the geologic cross sections and the mineral resources map may occur. The principal industrial mineral commodities discussed here include clay, dolomitic limestone, limestone, and sand.

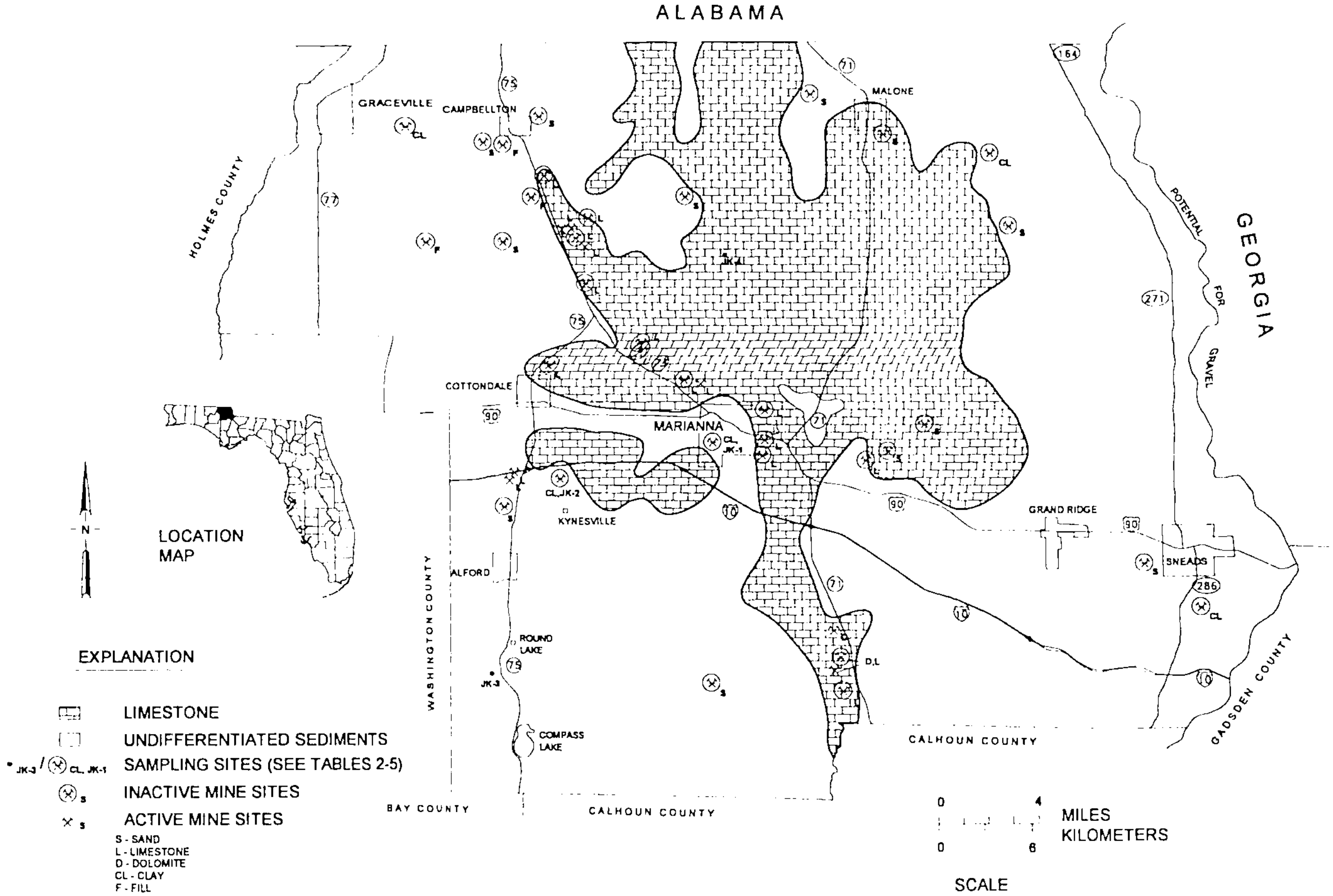

Figure 7. Mineral Resources of Jackson County, Florida

Clay

Small alluvial clay deposits can be found scattered in the flood-plains of the Apalachicola and Chipola rivers. Residual clays from the surficial formations are also present throughout the county, but few were ever found to be commercially significant. Past production locations and clay test sites include the old Round Lake RR Station south of Alford, an unnamed clay pit near Compass Lake, Barbour's clay pit near Kynesville, the Correctional School for Boys at Marianna, and the Blackman clay pit near Campbellton. Bell (1924) and Calver (1949) researched numerous clay deposits and presented their analyses in their respective publications.

Bell (1924) reported a clay deposit located at the Correctional School for Boys at Marianna. The clay was used to make common brick that was used locally. The red to gray colored clay deposit measured up to 12 feet thick with up to two feet of sandy clay overburden. Selected portions of Bell's (1924) and Calver's (1949) Jackson County clay research are shown in Tables 2 through 4.

George Aase and Associates (1964) contracted with the US Department of Commerce to study the feasibility of establishing a structural clay products industry in west Florida. The study encompassed seven nearby counties but ultimately found that only two, Liberty and Calhoun, had sufficient raw materials to sustain the industry. The report concluded that an industry of this type would be profitable. A copy of the report is on file at the FGS library.

Dolomitic Limestone

Dolomite, $CaMg(CO_3)_2$, is defined in Dana's Manual of Mineralogy (Hurlbut, 1959) as containing equal proportions of calcium carbonate and magnesium carbonate. Expressed in terms of weight percentages, he said it consists of 45.6 percent $MgCo_3$ and 54.4 percent $CaCO_3$. He further stated that as a rock term it has been applied to carbonate rocks containing as little as 15 to 20 percent by weight $MgCO_3$ while others in the industry use 35 to 40 percent by weight $MgCO_3$ as the dividing line. Dolomitic limestone from Jackson County analyzes from a trace to 40.6 percent magnesium carbonate (Reeves, 1961). The mineral resources map (Figure 7) shows dolomitic limestone mines are centered around the Chipola River in south-central Jackson County. There are two mines, Dixie Lime Products, and Dolime, Inc., operating in this region of Jackson County. Both of these companies are located west of State Road 71 and south of Interstate 10. The rock, which is from the Oligocene Suwannee Limestone, is tan to brown in color, unconsolidated to moderately indurated, and moldic. The Florida Department Of Transportation (FDOT) approved the dolomitic rock from local producers for use in road construction and as a base course material. It is also used locally as an aggregate material and as an animal feed supplement.

Limestone

Rock quarries in Jackson County date back to at least the early 1800's. In those early years the Marianna Limestone was quarried and used as a building stone (Figure 8). Later, building stone diminished as a commodity due to the increased use of concrete block and the rise in labor costs. Today, one can still visit a few of the old stone quarry sites and see cut limestone from that once thriving industry. Several of the older homes in the area were built using the locally obtained Marianna Limestone. Reeves (1961) published a thorough discussion of the industry in the tri-county region, which includes Jackson County. Schmidt et al. (1979) reported on the economic uses and locations of the limestone, dolomite, and coquina resources of Florida.

In the early 1960's, George Aase and Associates (1962a and b) completed feasibility studies for the U.S. Department of Commerce on the potential for a lime and a portland cement industry in west Florida. Their study area included but was not limited to Jackson County. Both reports concluded that the industries could have been successful endeavors. Aase and Associates based their findings on the fact that there were favorable market projections, substantial raw materials and reserves, and adequate transportation facilities. The 137 page lime report and the 169 page cement report were compiled for the US Department of Commerce; copies of the reports are located in the FGS library.

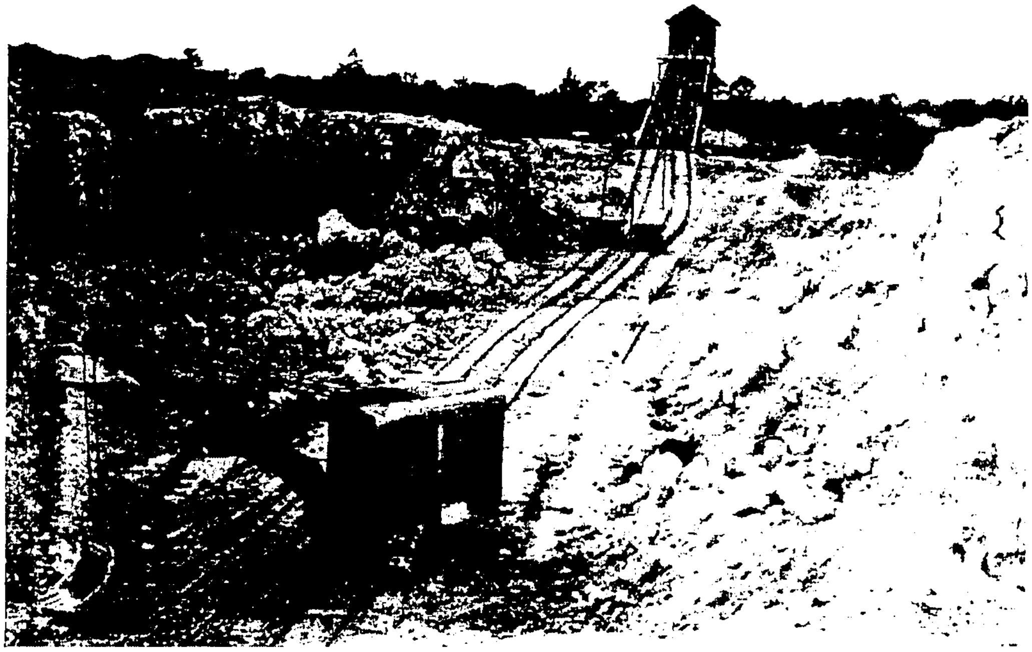

Figure 8. Florida Basic Rock Company Quarry, Jackson County, Florida, 1929 (FGS Photo Archives)

Today, limestone continues to be mined in Jackson County and is used by the Florida Department of Transportation (DOT) as a base course material for local roadways. The currently approved DOT quarries in Jackson County include White Construction Incorporated which operates a mine (Jones Pit) approximately eight miles north of Cottondale on County Road 162. Anderson Columbia Company's Imperial Mine is located near the White Construction pit but on the north side of County Road 162. Dolomite Incorporated operates a mine 10 miles south of Marianna along the west side of State Road 71. Most of the limestone from Jackson County mines is used in DOT approved projects for asphalt aggregate or roadway base course material.

Other operating mines or plants that are not included in the DOT's Jackson County list include Dixie Lime Inc., located 11.5 miles south of Marianna along State Road 71, and White Construction's Cottondale plant located two miles south of Cottondale. Gulf Asphalt has two sites in Jackson County. Their Deerhaven Mine is located two miles south of Cottondale near White Construction's plant, and the other mine is north of the intersection of State Road 231 and County Road 162. Marianna Lime Products, Inc. operates a limestone pit north west of Marianna along State Road 73.

Sand

Sand is found throughout many areas of the county. However, those deposits found in the higher elevations, namely those in the highlands of southwest Jackson County, tend to be coarser. Some washing is required to clean the sand. Other sand deposits scattered throughout the county tend to have a smaller grain size and need more cleaning. All of the sand that is excavated in the county is used locally as fill material.

Moore (1955) reported a small sand and gravel deposit four miles south of Cottondale off State Road 75 along the west side of the railroad. The quartzite gravel, which can range up to two inches in diameter, is highly fractured and therefore not suitable for use in concrete. The small pockets

Table 2. Physical Properties of the Correctional School Clay Deposit
(from Bell, 1924, map code JK-1, Figure 7)

Plasticity (by feel)	excellent
Water of Plasticity	36.65%
Pore water	0.46%
Shrinkage water	36.19%
Linear air shrinkage	14.40%
Modulus of rupture (average)	421.2 lbs./ sq. inch
Slaking test	5 minutes
Steel hard at cone 010	
Overfires at cone 012	

Table 3. Firing Tests, Correctional School Clay Deposit
(from Bell, 1924, map code JK-1, Figure 7)

Temperature, ^{O}C	Linear Shr., %.	Absorption, %	Porosity, %	Color
950	3.1	11.95	26.00	Brick Red
1050	10.6	8.05	20.75	Brick Red
1150	10.6	2.10	8.60	Brick Red
1190	12.6	1.70	7.5	Brick Red
1230	12.6	1.67	5.8	Brick Red
1310	13.6	1.50	6.1	Brick Red

Table 4. Physical Properties of Selected Jackson County Clay Sites
(from Calver, 1949)

Location	Cottondale	Marianna	Marianna	Marianna	Round Lake	Round Lake	Round Lake
Sample No.	0-109	0-237	0-121	0-122	0-123	0-241	0-242
Map Code, Figure 7	JK-2	JK-1	JK-1	JK-1	JK-3	JK-3	JK-3
Plasticity	good	fair	good	good	excel.	good	fair
Water of Plasticity	40	39	66	50	58	30	26
Linear Air Shrinkage	8.7	10.1	17.5	14.8	9.8	6.1	5.4
Modulus of Rupture	290	270	560	440	110	140	40
Slaking Test	fast	fast	fast	med.	fast	med.	med.
Color	gray	brown	red	dk. red	pink	red	red
Firing Tests							
Linear shrinkage (Per Cent.)							
Cone 010 (950^{O}C)	2.0	1.0	4.0	2.0	1.5	0.0	0.0
Cone 05 (1050^{O}C)	2.0	2.0	4.0	5.0	2.0	0.0	0.0
Cone 03 (1090^{O}C)	2.0	5.5	10.0	5.0	10.0	2.0	0.5
Cone 1 (1150^{O}C)	4.9	5.5	---	---	11.0	4.5	0.5
Cone 3 (1190^{O}C)	9.5	7.0	10.5	7.0	15.0	4.5	1.0
Cone 6 (1250^{O}C)	8.5	6.5	---	---	15.5	5.0	3.0
Color							
Cone 010 (950^{O}C)	white	brick red	red orange	red	pink	pink	pink
Cone 05 (1050^{O}C)	red	brick red	red orange	pink	pink	pink	pink
Cone 03 (1090^{O}C)	white	brick red	brown	brick red	pink	pink	pink
Cone 1 (1150^{O}C)	white	dark red	---	---	pink	gray red	pink
Cone 3 (1190^{O}C)	light cream	dark red	brown	brick red	brown	gray red	gray red
Cone 6 (1250^{O}C)	light cream	dark red	---	---	brown	gray red	gray red

of sand found at this location were worked years ago by the H.W. Johnson Company. The deposit that they worked was five to seven feet thick and had approximately three feet of overburden.

Martens (1928) reported that coarse sand and gravel is present in the bed and along the sides of the Chattahoochee River. Although no gravel has been extracted from the Jackson County side of the river it has been dredged from the Apalachicola River for years (Scott et. al, 1980).

Undifferentiated Resources

Much of Jackson County has surface and near-surface sediments made up of clayey sand, and organic muck. Although the potential for large scale mining is minimal due to the heterogeneous nature of these sediments, they may be valuable locally as fill material. Davis (1946) tested a shallow peat prospect located in section 5, Township 5 North, Range 10 West (Figure 7; Table 5). Peat is an accumulation of partly decomposed organic material (mainly plant matter) which accumulates in perennially wet areas. Along with the wet conditions that affect the accumulation of organic deposits, other factors of importance include topography and climate. The location of the peat prospect is shown on Figure 7.

Table 5. Peat Analyses
(from Davis, 1946, map code JK-4, Figure 7)

Moisture Free Basis, Analysis in Per Cent										
Proximate Analyses					Ultimate Analyses					
Sample Number	Thickness (inches)	Volatile Matter	Fixed Carbon	Ash	H	C	N	O	S	BTU
164	30	36.5	18.5	45.0	3.2	33.1	2.1	16.4	0.2	5610

REFERENCES

ase, G. and Associates, 1962a, Feasibility study of a proposed portland cement industry in redevelopment area A, West Florida; U.S. Department of Commerce, Area Redevelopment Administration, Contract No. Cc-5836, Washington D.C., unpublished report, 169 p.

__________________ 1962b, Feasibility study of a proposed lime industry in redevelopment area A, West Florida; U.S. Department of Commerce, Area Redevelopment Administration, Contract No. Cc-5836, Washington D.C., unpublished report, 137 p.

__________________ 1964, Feasibility study of a proposed structural clay products industry in redevelopment area A, Northwest Florida; U.S. Department of Commerce, Area Redevelopment Administration, Contract No. Cc-6028, Washington D.C., unpublished report, 127 p.

Applin, P.L., 1951, Preliminary report on buried pre-Mesozoic rocks in Florida and adjacent states: U.S. Geological Survey Circular 91, 28 p.

Arthur, J.A., 1988, Petrogenesis of Early Mesozoic tholeiite in the Florida basement and an overview of Florida basement geology: Florida Geological Survey Report of Investigation No. 97, 39 p.

Bell, O.G., 1924, A Preliminary report on the clays of Florida: Florida Geological Survey Fifteenth Annual Report, pp. 53-266.

Calver, J.L, 1949, Florida kaolins and clays: Florida Geological Survey Information Circular No. 2, 59p.

Chen, C.S.,1965, The regional lithostratigraphic analysis of Paleocene and Eocene rocks of Florida: Florida Geological Survey Bulletin No. 45, 105 p.

Cooke, C.W., 1939, Scenery in Florida as interpreted by a geologist: Florida Geological Survey Bulletin No. 17, 120 p.

Davis, J.H., Jr., 1946, The peat deposits of Florida, their occurrence, development, and uses: Florida Geological Survey Bulletin No. 30, p. 104.

Healy, H.G., 1975, Terraces and shorelines of Florida: Florida Bureau of Geology Map Series No. 71, scale 1:2,000,000.

Hendry, C.W., Jr. and Yon, J.W., Jr., 1958, Geology of the area in and around the Jim Woodruff Reservoir, Florida Geological Survey Report of Investigation No. 16, Part I, 52 p.

Hurlbut, Cornelius, Jr., 1959, Dana's manual of mineralogy: John Wiley & Sons, Inc., New York, 17th ed., 609 p.

Lloyd, J.M., 1985, Annotated bibliography of Florida basement geology and related regional and tectonic studies: Florida Geological Survey Information Circular No. 98, 72 p.

MacNeil, F.S., 1950, Pleistocene shorelines in Florida and Georgia: U.S. Geological Survey Professional Paper 221-F, p. 95-107.

Martens, J.H.C., 1928, Sand and gravel deposits of Florida: Florida Geological Survey 19th Annual Report, p. 93-94.

Moore, W.E., 1955, Geology of Jackson County, Florida: Florida Geological Survey Bulletin No. 37, 101 p.

Puri, H.S., 1953, Contribution to the study of the Miocene of the Florida panhandle: Florida Geological Survey Bulletin No. 38, 345 p.

__________ and Vernon, R.O., 1964, Summary of the geology of Florida and a guidebook to the classic exposures (revised): Florida Geological Survey Special Publication No. 5 (revised), 312 p.

Reeves, W.D., 1961, The limestone resources of Washington, Holmes and Jackson Counties, Florida: Florida Geological Survey Bulletin No. 42, 121 p.

Schmidt, W. and Coe, C., 1978, Regional structure and stratigraphy of the limestone outcrop belt in the Florida panhandle: Florida Bureau of Geology Report of Investigations No. 86, 25 p.

________, Hoenstine, R.W., Knapp, M.S., Lane, E., Ogden, G.M. Jr., and Scott, T.M., 1979, The limestone, dolomite, and coquina resources of Florida: Florida Bureau of Geology Report of Investigation No. 88, 54 p.

Scott, T., 1993, Geologic map of Jackson County, Florida: Florida Geological Survey Open File Map Series No. 25, Approximate Scale 1:125,000.

________, in preparation, Geomorphic map of Florida, Florida Geological Survey Map Series.

________, Hoenstine, R.W., Knapp, M.S., Lane, E., Ogden, G.M. Jr., Deuerling, R., and Neel, H.E., 1980, The sand and gravel resources of Florida: Florida Bureau of Geology Report of Investigation No. 90, p. 7.

White, W. A., 1970, The geomorphology of the Florida peninsula: Florida Bureau of Geology Bulletin No. 51, 164 p.