

STATE OF FLORIDA
DEPARTMENT OF NATURAL RESOURCES
Elton J. Gissendanner, *Executive Director*

DIVISION OF RESOURCE MANAGEMENT
BUREAU OF GEOLOGY
Charles W. Hendry, Jr., *Chief*

REPORT OF INVESTIGATION NO. 88

THE LIMESTONE, DOLOMITE
AND COQUINA RESOURCES OF FLORIDA

by
Walter Schmidt
Ronald W. Hoenstine, Michael S. Knapp,
Ed. Lane, George M. Ogden, Jr., Thomas M. Scott

Prepared by the
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TALLAHASSEE
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LETTER OF TRANSMITTAL



**Bureau of Geology
Tallahassee**

November 19, 1979

Governor Bob Graham, Chairman
Florida Department of Natural Resources
Tallahassee, Florida 32304

Dear Governor Graham:

The Bureau of Geology, Division of Resource Management, Department of Natural Resources is publishing as its Report of Investigations No. 88, "The Limestone, Dolomite and Coquina Resources of Florida."

This report discusses the geological occurrence, uses, market trends and mining methods of the limestones, dolomite, and coquina deposits found throughout Florida. This information, I believe, will materially assist in the future development of these resources in Florida.

Respectfully yours,

Charles W. Hendry, Jr., Chief
Bureau of Geology

Printed for the
Florida Department of Natural Resources
Division of Resource Management
Bureau of Geology

Tallahassee
1979

CONTENTS

	Page
Introduction - Walter Schmidt	1
Purpose and Scope of Investigation	1
Acknowledgements	1
General Statement	1
Limestone, Dolomite, and Coquina: A Background	1
General Uses	2
Geology of Florida's Limestone, Dolomite, and Coquina	
Deposits - Thomas M. Scott	3
Northwest Florida	4
Western Half of North and Central Peninsular Florida	6
Atlantic Coast	9
Southwest Florida	10
The Uses of Limestone - Michael S. Knapp, Ronald W. Hoenstine	11
Transportation	14
Quarry Sites	14
Market Trends - Ronald W. Hoenstine	15
Roadbase and Concrete Aggregate	17
Agricultural Limestone	17
Lime	17
General Future Trends	20
Economic Factors	21
Mining Methods and Beneficiation - Ed Lane	22
Mining Methods	22
Processing and Beneficiation	23
Cement Manufacturing	27
Mineral Producers - George M. Ogden, Jr.	34
References	52

ILLUSTRATIONS

Figure	Page
1. Number of active quarries producing limestone, dolomite, and coquina in Florida for the period 1965-1977	15
2. Production and value for crushed limestone from all sources (limestone, dolomite, and coquina) in Florida for the period 1966-1977	16
3. Percentages of total Florida limestones that are used for agriculture and for cement, road, and construction aggregate for the period 1966-1975	18
4. Florida lime production for the period 1968-1977	19
5. Portable rock crusher	24
6. Simplified processing diagram for limestone, dolomite, and coquina	25
7. Large crusher/screener plant	26
8. Schematic diagram of the flow-process of materials through a modern "dry-process" cement plant	28
9. Dry-pit limestone quarrying operation	29
10. Conveyor belt from quarry to plant	30
11. Proportional blender unit	31
12. Overall view of cement plant	32
13. Main control room of cement plant	33

MAPS (in pocket)

1. Geologic Map of Surface and Near Surface Deposits of Limestones, Dolomites, and Coquinas in Florida
2. Physiographic Map of Florida
3. Limestone Resource Potential Map of Florida
4. Dolomite Resource Potential Map of Florida
5. Coquina Resource Potential Map of Florida

INTRODUCTION

Purpose and Scope of Investigation

This report summarizes the known data relating to the occurrence of the limestone, dolomite, and coquina resources of the State of Florida and the uses of these commodities. The information presented is not intended to be an exhaustive study leading to immediate commercial development, however, the conclusions and statements made herein are based on extensive research by the Florida Bureau of Geology. Preparation for this report included geological field reconnaissance, examination of well cuttings and core samples, analysis of data from private industry, and comprehensive literature search. This study may be considered an up-to-date "state-of-the-art" report including uses and the locations of economic deposits of limestone, dolomite, and coquina in Florida.

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GENERAL STATEMENT

The State of Florida is underlain by more than 4,000 feet of sedimentary rocks that overlie a basement of older sedimentary, metamorphic, and igneous rocks. Most of the state is covered by a surface mantle of soils, sands, and clayey sands that may reach several hundred feet in thickness. This mantle obscures the underlying carbonates (limestone, dolomite, and coquina), except where they are exposed in stream valleys, sink holes, coastal lowlands, and other areas where the cover is thin or absent as a result of erosion.

LIMESTONE, DOLOMITE AND COQUINA: A BACKGROUND

The term limestone has its origin in the mineral industry. In the literal sense it means a stone from which lime can be produced. Geologists, however, refer to a large group of rocks as limestone, regardless of their value for the production of lime. The geologist would include as limestones those sedimentary rocks made up of 50 percent or more of the minerals

calcite (calcium carbonate) and dolomite, (calcium magnesium carbonate), with calcite being the predominant mineral. Most commercial limestones are 90 percent or more calcium carbonate.

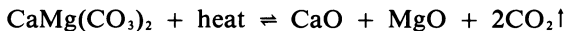
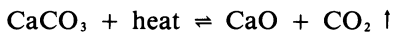
Dolomite is far less common than calcite. It can be defined as a sedimentary rock containing more than 50 percent of the minerals calcite and dolomite, with dolomite being the most abundant. Dolomite most often forms by subsequent alteration (recrystallization) of a limestone after its deposition. In many cases the major features of the limestone, such as bedding or chert nodules, may carry over into the dolomite.

Coquina consists primarily of cemented mollusk shells in varying degrees of preservation. Generally, the shells are loosely held together by a calcareous cement. In Florida the rock varies from a sandy limestone, to a calcareous sandstone, to unconsolidated sand and shells.

Coquina was the first of Florida's mineral resources to be utilized by early European settlers. The name has its origin from a Spanish word meaning cockle or shellfish. Early Spanish settlers applied the name to the deposits of shell near St. Augustine. The harder layers were used in building forts and missions.

GENERAL USES

Limestone and dolomite both possess a property which has been known for quite some time: When they are heated they lose carbon dioxide and yield lime.



In addition, limestone and dolomite have in common the following uses: (1) as crushed stone for concrete aggregate, road metal, railroad ballast, and sewage filter beds; and when ground finer, for poultry grit, stucco, a stabilizer for coal mine dust, filler, and whiting; (2) as a fluxing agent, in the smelting and refining of iron and other metals; (3) as dimension stone; (4) as a chemical raw material, as in glassmaking and acid neutralization; (5) as a soil conditioner, often referred to as "agricultural lime" or "aglime", which is used to correct soil acidity and promote plant growth.

Limestone is a basic raw material for Portland cement manufacture, and dolomite is the source of certain high-grade refractory materials.

Coquina was used extensively in the past for building stone. An important characteristic of the rock is that, though somewhat soft when first cut, it tends to "case harden" on the outside after exposure to the elements. The famous Fort Castillo de San Marcos at St. Augustine is made from cut coquina. More recently several public buildings along the East Coast of Florida have been built with facings of coquina blocks. The dominant use at present, however, is for roadbase.

THE GEOLOGY OF FLORIDA'S LIMESTONE, DOLOMITE, AND COQUINA DEPOSITS

Limestone and dolomites presently mined in the State of Florida range in age from late Middle Eocene (42 million years ago, MYA) to Pleistocene (.5 MYA). The mining in the Florida panhandle and the western half of the northern and central peninsula utilizes carbonates that range in age from late Middle Eocene to Upper Oligocene and Middle Miocene. Southwestern Florida mining operations produce limestone from rocks ranging from Middle or Upper Miocene to Pliocene Age. Pleistocene Age limestones and lithified coquina are mined along the Atlantic coast from the Florida Keys in Monroe County north to Flagler and St. Johns counties.

Several geologic factors control the mining potential of limestones and dolomites. Lithology, structure, and geomorphology all are important factors that dictate where mine activities will be economically feasible. The lithologic character of the rocks is the most variable of the three factors. The lithology of any carbonate section may change quickly due to many factors including facies transition, alteration of the rock due to ground water action, varying degrees of dolomitization, and the dolomitization of differing facies creating a varying dolomite lithology. Other lithologic variables such as sand and clay content also affect the quality of the rock, and may render it useless for certain products.

Structure and geomorphology are much more generalized in their effects on potential mining. Structural control is related to the attitude of the carbonate units and to faulting. The dip of the units, which in Florida is generally less than 30 feet per mile, can cause the limestone or dolomite unit to become more deeply buried beneath undesirable or non-economic units down-dip. Conversely, in an up-dip direction, the unit being mined may have been removed by erosion, thus exposing underlying units which may or may not be economically important. Faulting may also cause rapid changes in lithology within a relatively short distance. This results from the up-thrown side of the fault exposing older rocks to erosion while the downthrown side protects the older rocks from erosion by burying them with younger sediments. An example of this is discussed by Pride, et al (1966) in a report on the Green Swamp.

The limestone and dolomite units are often buried by younger geomorphic features. These landforms are marine, deltaic, fluvial, and solution related in origin. The effect of these geomorphic features can create conditions under which limestone or dolomite production is no longer economical. The relation of these landforms to the carbonate units will be discussed in each section.

The geology of Florida's limestone and dolomite resources will be discussed in four sections based on location within the state. Each section

has its own unique geologic setting. The areas to be discussed will be northwest Florida, the western half of the northern and central peninsula, the Atlantic Coast, and southwestern Florida.

NORTHWEST FLORIDA

Active and potential limestone and dolomite mining areas of the Florida panhandle lie within a four-county area which includes Walton, Holmes, Washington, and Jackson counties. The carbonate resources of this area have been discussed by many previous authors. Vernon (1942), Moore (1955), and Schmidt and Coe (1978) have discussed the stratigraphy and structure of the area. Moore (1955) also presents a detailed discussion of previous authors' works. Reves (1961), Shirley and Sweeney (1965), and Yon and Hendry (1969) all investigated the area's limestone resources.

Stratigraphically, the oldest limestones available for mining in northwest Florida belong to the Upper Eocene Ocala Group. As shown on Map 1 (in pocket), the limestones of the Ocala Group crop out in a broad band along the Florida-Alabama border in Jackson and Holmes counties. They also extend southward into extreme northwestern Washington County.

The limestones of the Ocala Group are white to cream colored, usually poorly indurated, permeable, granular, fossiliferous to highly fossiliferous, and very high in calcium carbonate content. Texturally, the sediments grade from very chalky through microquartz to a coarse allochemical limestone composed almost completely of fossil material. The high purity (percent CaCO_3) varies slightly with the exception of a lower facies described by Vernon (1942), which occurs in northern Holmes County and contains considerably more quartz sand and glauconite. Induration varies from the common poor induration to moderate induration with areas of well indurated, recrystallized, dense limestone. The well indurated, recrystallized rocks generally cover only small areas (Reves, 1961).

The thickness of the Ocala Group in this area ranges from 200 to 300 feet (Vernon, 1942; Moore, 1955; Reves, 1961). The direction of the dip of the beds varies from southeast in eastern Jackson County to south and southwest in central and western Jackson County and in Holmes and Washington counties (Vernon, 1942; Reves, 1961). The dip averages between 12 to 20 feet per mile (Reves, 1961).

The existence of faulting in Jackson County was discussed by Moore (1955). He identified what he believed to be a large fault in the central portion of the county, and named it the Cypress Fault. Schmidt and Coe (1978) could not substantiate the existence of this fault in their lithostratigraphic study.

The Marianna Limestone, of Oligocene Age, overlies the Ocala Group and crops out in a narrow band immediately south and southwest of the

Ocala Group. It occurs in a narrow band across central Jackson, northern Washington, and southwestern Holmes counties, and into northeastern Walton County.

The Marianna Limestone is white, cream to light gray in color. It is slightly glauconitic (Moore, 1955) and sandy (Vernon, 1942) in thin beds. The limestone generally appears massive and impermeable with an abundant foraminiferal fauna. It is soft in fresh exposures but case hardens upon exposure to the atmosphere. There are local occurrences of hard recrystallized limestone.

The thickness of the Marianna Limestone is fairly uniform throughout this area. It ranges from approximately 25 feet in some areas of Jackson County to as much as 45 feet in Washington and Holmes counties. It thins to zero due to erosion toward the Eocene outcrop. The beds dip generally southward at a rate of 11 to 18 feet per mile (Reves, 1961). However, Moore (1955) reports a dip of 64 feet per mile in part of Jackson County. This, he believes, is associated with the Cypress Fault.

The Marianna Limestone is overlain by the Suwannee Limestone, of Oligocene Age. It crops out in a narrow band immediately south of the Marianna outcrop belt, and follows the same trend across the four-county area as the Marianna Limestone.

The Suwannee Limestone is a cream to buff colored, poorly to well indurated, extremely fossiliferous, porous, massive limestone. It may occasionally contain beds of chalky, soft limestone. Small areas of highly recrystallized limestone frequently occur but apparently with no regular arrangement. In portions of Jackson County the Suwannee varies from a dolomitic limestone to a dolomite, which is mined in the Chipola River Valley. Silicified zones also occur scattered about the limestone surface.

The thickness of the Suwannee is quite variable due to erosion of its surface prior to the deposition of the Tampa Stage limestones (Chattahoochee and St. Marks Formations). The Suwannee thickens from a feather edge at the Marianna outcrop, to over 200 feet thick in the sub-surface down-dip in Jackson County. The dip varies from 10 to 20 feet per mile. Moore (1955) suggests a dip of 64 feet per mile in the vicinity of the Cypress Fault in Jackson County.

Overlying the Suwannee is the Chattahoochee Formation of Upper Oligocene and Miocene Age (Poag, 1972). It crops out immediately south of the Suwannee outcrop belt and follows the same trend. The Chattahoochee is buried by younger sediments to the south.

The lithology of the Chattahoochee Formation is quite variable within the four-county area. In Holmes and Washington counties it is predominately a sandy, silty limestone with greenish, argillaceous silts occurring at its base. In Jackson County, it is characterized as an

argillaceous limestone that is white to cream in color, very silty to sandy, and chalky to crystalline (Hendry and Yon, 1958).

The Chattahoochee appears to be thickest in Jackson County, near the Jim Woodruff Dam where it is 227 feet thick (Hendry and Yon, 1958). It thins to 100 feet or less in the southwestern part of the county. In Holmes and Washington counties it averages 50 feet in thickness.

The dip of the Chattahoochee varies from 12 feet per mile in Washington County to approximately 20 feet per mile in Holmes county. The dip is approximately 13 feet per mile in Jackson County.

The geologic map (Map 1, in pocket) shows relatively large areas of limestone within northwestern Florida. However, due to the physiography of the region these limestones are often buried to an unmineable depth. By comparing the geologic map (Map 1), the physiographic map (Map 2, in pocket), and the limestone and dolomite potential maps (Maps 3 & 4, in pocket), it becomes clear the effect that the physiography has on the potential for mining the limestone and dolomite resources of northwest Florida.

THE WESTERN HALF OF NORTH AND CENTRAL PENINSULAR FLORIDA

This area includes the counties of the "Big Bend" south to Manatee County. Included are the counties of Wakulla, Jefferson, Taylor, Lafayette, Suwannee, Dixie, Gilchrist, Alachua, Levy, Marion, Citrus, Sumter, Hernando, Pasco, Hillsborough, Polk, and Manatee. This 17-county area has been discussed by many authors. These include Yon (1966), *Geology of Jefferson County*; Puri, Yon and Oglesby (1967), *Geology of Dixie and Gilchrist Counties*; Clark, Musgrove, Menke, and Cagle (1964), *Water Resources of Alachua County*; Vernon (1951), *Geology of Citrus and Levy Counties*; Puri (1957), *Stratigraphy and Zonation of the Ocala Group*; Yon and Hendry (1972), *Suwannee Limestone in Hernando and Pasco Counties*; Peek (1958), on Manatee County; Stewart (1966), on Polk County; Pride, Meyer, and Cherry (1965), on the Green Swamp; White (1970), *Geomorphology of the Florida Peninsula*; and many others. Each of these previous authors discuss other authors who have completed investigations in this area. These reports may be consulted for more information and further additional references.

Stratigraphically, the oldest formation cropping out in the state, the late Middle Eocene Avon Park Limestone, is found in this area. In Levy County where the Avon Park is being mined at the present time, it is a tan to brown, thin bedded, laminated, finely crystalline dolomite. The Avon Park varies from very porous and soft to dense and well indurated. Layers of fine, silt-sized dolomite occur throughout the Avon Park section. Layers of lignite commonly occur, as do layers of carbonaceous plant fossils. Fossil molds are very common in the more porous zones. The Avon Park also occurs as a

cream to brownish, highly fossiliferous, soft, porous limestone, but is not economically significant. Vernon (1951) estimates the thickness of the Avon Park to be 200 to 300 feet in Levy County. It thickens in the subsurface east and southeast of the crest of the Ocala High (Citrus and Levy counties) and may reach as much as 600 feet thick in eastern peninsular Florida. West of the crest, the Avon Park dips southwest at approximately 15 feet per mile. East of the crest, it dips to the northeast and east at the same gentle rate. The Ocala High plunges gently to the southeast and the dip of the Avon Park follows that trend south of the outcrop area. The geologic map (Map 1) shows where the Avon Park occurs in outcrop or in the shallow subsurface.

The Upper Eocene Ocala Group limestones overlie the Avon Park Limestone and crop out in a roughly oval pattern around the Avon Park outcrop (Map 1). The Ocala Group is divided into three formations based on lithology and paleontology. The three formations are in ascending order: the Inglis Formation, The Williston Formation, and the Crystal River Formation, as named by Vernon (1951) and Puri (1957). The lowest formation, the Inglis, is a cream to tan, granular, porous, massive, semihard, fossiliferous limestone. It is occasionally a coquina of foraminifers, mollusks, and echinoids (Vernon, 1951). The base of the unit may be dolomitized to varying degrees. When the dolomite occurs it is usually tan to brown, porous, soft to hard and massive. Vernon (1951) reports the base of the unit is generally marked by a rubble zone whose source is the Avon Park Limestone. The Inglis may be cross-bedded as can be seen along the Gulf portion of the Florida Barge Canal and in pits in the surrounding area. The Inglis is approximately 50 feet in thickness.

The Williston Formation overlies the Inglis. It has two lithologic types that interfinger. One is a cream colored limestone that is a soft, friable coquina of foraminifers. The other is a cream to tan, highly fossiliferous detrital limestone (Vernon, 1951). Masses of silicified limestone occur and are generally found near the Williston-Inglis contact (Vernon, 1951). Vernon (1951) describes the top of the Williston as "a transition zone, having faunal similarities with the Ocala Limestone (now called Crystal River Formation) but generally differing in lithology, being harder, more granular, and containing fewer specimens of large foraminifers". The Williston in the area of potential mining averages 30 feet in thickness.

The Crystal River Formation lies above the Williston and is typically white to cream, soft, very massive, friable coquina of large foraminifers in a pasty calcite matrix (Vernon, 1951). Occasional thin beds of a more granular miliolid-rich limestone occur, and they also appear at the base as a transitional zone between the Crystal River and the Williston formations. The thickness of the Crystal River Formation is highly variable since the top of the formation has been exposed to erosion several times after deposition.

This highly irregular surface is often penetrated by solution features (sinks and solution pipes), as is much of the lower Ocala Group. The total thickness of the Crystal River varies from zero to a maximum of nearly 300 feet in the subsurface of the peninsula. The thickest exposure of the Crystal River is located in the Crystal River Quarry in Citrus County where 108 feet of the limestone is exposed.

Structurally, the Ocala Group crops out in a roughly oval pattern near the crest of and on the flanks of the Ocala High. It dips off the elongate high in all directions. For further information consult the various references for the Ocala Group, particularly Vernon (1951) and Puri (1957).

Unconformably overlying the Ocala is the Suwannee Limestone of the Oligocene Epoch. It is a pale orange, finely crystalline, thin bedded, soft to hard, dense, porous, very fossiliferous limestone. The lithification varies from soft and friable to well indurated, highly recrystallized. In Jefferson and Taylor counties the Suwannee exhibits varying degrees of dolomitization. The dolomitic limestone is tan to brown, porous to dense, fossiliferous, and moldic. It occurs in a band of varying width that parallels the coastline. Boulders of silicified limestone are very common in the outcrop areas.

The Suwannee Limestone crops out on the northwestern and southeastern ends of the Eocene outcrop area (Map 1). It does not occur on the eastern flank of the Ocala High, either because of nondeposition or erosion. The thickness of the Suwannee is highly variable due to erosion and varies widely throughout the outcrop belt, reaching more than 200 feet in thickness in the subsurface of Pasco and Hernando counties.

Overlying the Suwannee is the St. Marks Formation of the Tampa Stage, considered Lower Miocene. Yon (1966) described the St. Marks Formation in north Florida as a white to very pale orange, finely crystalline, sandy, silty, clayey limestone (calcilutite) with poor to moderate porosity. Menke and others (1961) described the "Tampa" limestone (St. Marks) of Hillsborough County as a white to cream and gray, hard to soft, sandy limestone containing many fossil molds.

The St. Marks Formation crops out or is near the surface in two widely separated areas. One is in northern Florida in Wakulla and Jefferson counties and the other is in central Florida in Pasco and Hillsborough counties. In Jefferson County it is a maximum of 120 feet thick and dips to the south. In Pasco and Hillsborough counties the St. Marks is of quite variable thickness and dips generally to the south and southwest.

The Middle Miocene Hawthorn Formation overlies the St. Marks Formation. The Hawthorn consists of two dominant lithologies, an upper clastic unit and a lower carbonate unit. The carbonate unit varies in composition and thickness throughout the state and is of economic importance only where it is near the surface. The carbonate Hawthorn is mined, or

could be mined, in parts of Polk, Hillsborough, and Manatee counties. As described by Peek (1958) in Manatee county, the Hawthorn consists of gray, bluish-gray, and greenish-gray, sandy, calcareous clay interbedded with white, gray and tan sandy limestone and thin beds of sand and shells. The limestones contain varying amounts of chert and dolomite. Dolomite is very abundant in the Hawthorn of western Manatee County where it is mined. In many instances, the dolomites are very crystalline and hard.

The Hawthorn thickens down-dip to the south and varies from 150 feet to over 300 feet thick in the subsurface.

Limestone and dolomite in western peninsular Florida are mined predominantly from the Gulf Coastal Lowlands. Several highland features influence the economics of the resource and these are shown on Map 2. A comparison of the physiographic map (Map 2), the geologic map (Map 1), and the potential map (Map 3) relate the influences of geomorphology, stratigraphy, and lithologies.

ATLANTIC COAST OF FLORIDA

The limestones and lithified coquina actively mined along Florida's Atlantic Coast occur from St. Johns County on the north to Monroe County in the Keys. The lithified coquina occurs in the Pleistocene Anastasia Formation and forms the backbone of the Atlantic Coastal Ridge south to approximately the Palm Beach-Broward County line. South of that county line to the Keys the Pleistocene Miami Oolite forms the ridge and is actively mined for limestone. The limestones of the Florida Keys belong to two formations, the Key Largo Limestone and the Miami Oolite. The Upper Keys, from Soldier Key to Big Pine Key, are composed of the Pleistocene Key Largo Limestone while the Lower Keys are Miami Oolite. As seen on Map 1 the Upper Keys are designated as the Coral Keys while the Lower Keys are the Oolite Keys.

Lithologically, the Anastasia Formation consists primarily of a sandy coquina of mollusk shells held loosely together by a calcareous cement (Puri and Vernon, 1964). Cooke (1945) states "the most conspicuous part of the Anastasia is coquina, a deposit of whole or broken shells that have been more or less firmly cemented by calcium carbonate, iron oxide, or other binding material. All gradations can be found between coarse rock, composed almost entirely of unbroken shells, and sandstones in which all the shells have been reduced to rounded grains of coral sand."

The Anastasia Formation represents an ancient beach facies and occurs only in a band of limited extent. It occurs rarely more than 5 miles inland from the Intracoastal Waterway where it interfingers with and is equivalent to unnamed contemporaneous deposits and, in south Florida, the marine members of the Ft. Thompson Formation (Parker, et al 1955). Southward

the Anastasia interfingers with and grades into the Miami Oolite which replaces it as the core of the Atlantic Coastal Ridge. Parker, et al (1955) states that the Anastasia may exceed 100 feet thick in some areas.

The Miami Oolite is typically a soft, white to yellow, stratified to massive, cross-bedded, sandy to pure limestone analyzing as high as 95 percent CaCO_3 , and consists of small, spherical ovules with marked concentric structure (Puri and Vernon, 1964). It reaches a maximum thickness of nearly 40 feet under the ridge and thins away from it. The Miami Oolite is often pitted with numerous sand-filled solution cavities. It is found underlying nearly all of Dade County, much of Broward County, a very small area of Collier County, Florida Bay, and the Lower Keys of Monroe County. The Miami Oolite interfingers with the upper part of the Key Largo Limestone and overlies the lower, older part of the Key Largo to the south. It overlies the Ft. Thompson in some areas of the Everglades to the west of the coastal ridge.

The Key Largo Limestone represents an ancient coral reef tract and its associated environments. It forms the Upper Keys of the Florida Keys in Monroe County. Lithologically, it is a white to cream colored, coralline limestone, with 40 percent composed of skeletal remains of reef-building corals, and the rest being a skeletal limestone containing remains of coral, mollusks, foraminifers, coralline algae, and echinoids (Puri and Vernon, 1964). Cooke (1945) states that it is highly variable in appearance and structure ranging from a fine, white, compact, homogeneous limestone to the coralline limestone described above.

The Key Largo Limestone interfingers with both the Miami Oolite on the mainland and in the Lower Keys and the Ft. Thompson on the mainland. Parts of the Upper Key Largo Limestone are the same age as the Miami Oolite, while the lower portion is older and is equivalent in age to the Ft. Thompson Formation.

SOUTHWEST FLORIDA

Active limestone mining operations occur in Lee, Hendry, and Collier counties of Southwest Florida. The limestone is predominately mined from the Plio-Miocene (7-10 MYA) Tamiami Formation. Some secondary mining activity removes limestone from the Pleistocene Ft. Thompson (?) Formation near Lake Okeechobee. The limestone surface is generally buried by a thin layer of quartz sand usually referred to the Pleistocene Epoch, (1.5 MYA), which is easily removed prior to mining.

Lithologically, the limestones of the upper Tamiami Formation are tan to white, soft to very hard, sandy, and contain an abundant and varied fauna of mollusks, barnacles, echinoids, and corals. Preservation of fossils varies from excellent to mostly moldic in a highly recrystallized matrix

(Meeder, 1979). Several facies of the upper Tamiami have been named, while others remain unnamed and their relationships are still questioned (Meeder, personal communication, 1979; Hunter, personal communication, 1979).

Dubar (1958) states that the Tamiami Formation ranges from 40 to 100 feet in thickness in the area of the Caloosahatchee River in Lee and Hendry counties. Parker (1955) gives a maximum Tamiami thickness of 150 feet in south Florida.

Limited mining of Ft. Thompson limestones and possibly lithified portions of the Caloosahatchee Formation occurs locally, but is of little economic significance.

THE USES OF LIMESTONE

The uses of limestone and dolomite are so variable and abundant that a list of specifications is beyond the scope of this report. Certain uses of limestone and dolomite are dependent upon the chemical composition, whereas other uses are largely controlled by the physical characteristics (Bowles, 1956). The following is a listing of the major uses of limestone modified after Wood (1958).

RAW MATERIAL	Cement, agriculture (liming), stock feeds, synthetic whiting, rubber, calcium cyanamid, calcium carbide, insecticides, abrasives, glass
BONDING AGENT	road-soil stabilization, sand-lime brick, asphalt paving, mortars, plasters, insulation materials, silica brick, stuccos
NEUTRALIZATION	water treatment, sewage treatment, fine chemicals, citric acid, gasoline, wood distillation, calcium phosphates, dyestuffs, metal pickling wastes, explosives wastes, chrome chemicals, acid mine drainage
FLOCCULATION	water purification, industrial waste treatment, paint pigments, sugar, ore flotation, salt processing.
SOLVENT	gelatin, animal glue, leather (dehairing), casein paints, strawboard
ABSORPTION	bleaches, gas purification, sulfite pulp
HYDROLIZATION	soap, pulp cloth, lubricating grease, organic chemicals, ammonia
FLUX	alumina, open hearth steel, electric furnace steel, non-ferrous metals
LUBRICANT	oil-well muds, wire drawing
CAUSTICIZATION	caustic soda, soda and sulfate pulp

Nationally the limestone industry is divided into two groups: The producers of crushed and broken stone, and the producers of cut or dimensional stone. Dimensional stone is not currently produced in Florida, although in the past, Florida limestones and coquinas were extensively used for building block.

The limestone used for limerock base and stabilized base material must meet both chemical purity and certain physical requirements as specified in the Florida Department of Transportation Standard Specifications For Road and Bridge Construction (section 911 1-6, page 541). The minimum percentage of carbonates of calcium and magnesium in the limerock material shall be 70 percent. The liquid limit¹ for both limerock and limerock stabilized base material shall not exceed 35. The limerock base material shall be non-plastic and the limerock stabilized base material's plastic index² shall not exceed 10. The limerock also shall not contain any harmful materials such as chert, extremely hard pieces or lumps, balls, or pockets of sand or clay size material in sufficient quantity to be detrimental to the proper bonding, finishing or strength of the limerock base. The gradation and size requirement for limerock base is that at least 97 percent (by weight) of the material shall pass a 3½ inch sieve and that the material shall be graded uniformly to dust. The size requirement for limerock stabilized base differs from the limerock base in that 97 percent of the material shall pass the 1½ inch sieve. The limerock material used in construction of limerock base shall have an average limerock bearing ratio of not less than 100.

²The plastic limit of a material is the water content, expressed as a percentage of the weight of the oven-dried material, at the boundary between plastic and semisolid states (ASTM 1978).

(ASTM) 1978 manual and include the Los Angeles abrasion test, Deval abrasion test, the Dory hardness test, the Page impact test, and ordinary crushing strength tests. In Florida the Los Angeles abrasion test is normally the only test conducted on potential aggregate material.

The next most common use for the limestones and dolomites of Florida is for agricultural stone. The limestones and dolomites are used as fertilizer, soil conditioners, and correcters for soil acidity. The major prerequisite for the limestone or the dolomite used as agricultural stone is that it have a high percentage of calcium or magnesium available for improving the soil.

Limestone dust is used as a filler in road asphalt surface mixtures. The Florida Department of Transportation requires that 65 percent of the material shall pass a no. 200 sieve, 95 percent of the material shall pass a no. 80 sieve, and 100 percent of the material shall pass a no. 30 sieve. Their specifications also stipulate that no phosphate shall be present in the mineral filler.

Another use for limestone and dolomite is as rip rap. Rip rap consists of heavy, irregular blocks used primarily for harbor and river erosion control structures such as jetties, spillways at dams, docks, and sea walls. The Florida Department of Transportation requires that rip rap materials be sound and durable, with specific gravities of at least 1.90. The rip rap shall be free of cracks, soft seams and other structural defects. The pieces shall be roughly angular and shall be reasonably free from thin, flat or elongated pieces.

Limestone screenings are used in place of silica sand in many areas of the state for roofing gravel, playground surface, concrete block manufacture, and poultry grit. When used as roofing gravel the limestone chips are mixed with tar for coating flat roofs. Limestone screenings without a binder make good surfaces for playgrounds, schoolyards, and walkways. Concrete blocks almost always have some limestone aggregate incorporated within them. Crushed limestone is satisfactory for sewage filter beds.

Impurities in limestone such as marcasite, pyrite, and clay should be avoided. Siliceous impurities are not objectional as long as they are fine-grained and evenly distributed. The limestone fragments should be compact and strong with rough surfaces. Fines and dirt should also be screened out of the limestone.

Finely ground limestone or dolomite is often used as a whiting substitute in ceramic raw materials and as fillers in numerous products, which include rubber, paint, paper, oilcloth, window shades, and linoleum.

Limestone is the major raw material used in making Portland cement and lime. The manufacturing processes for cement are discussed in detail in the section on Mining Methods. Briefly, cement manufacture requires the chemical conversion of limestone (calcium carbonate) to lime (calcium oxide). This conversion is accomplished by a calcination process, which is the

burning of limestone at high temperature in special kilns to drive off the CO_2 (Reves, 1961). It is not necessary to have pure limestone as a raw material. However, limestones that have high percentages of calcium carbonate are most desirable, since processing is simplified. The limestone should be free of iron-rich concretions, and it should be low in silica, alumina, magnesium, and sulfur.

In addition to cement, lime is an important and essential raw material for numerous other industries. It is one of the most widely used chemical reagents in the chemical and other manufacturing industries. Lime's physical properties make it a valuable commodity to the building industry. In agriculture lime is widely used as a soil corrective.

The manufacture of lime generally requires an exceptionally pure limestone for the kiln, with total carbonates more than 97 percent. A high carbonate content is desirable because virtually all of the impurities in the limestone remain in the lime after calcination.

Both high-calcium and high-magnesium limestones can be used in these operations. The physical properties of the limestone are also important, but requirements vary with the method of manufacture. A sound and compact stone is desirable for a vertical shaft kiln operation because it does not produce an excess of fines, which retard the draft in the kiln. For a horizontal rotary kiln operation finer materials may be used.

TRANSPORTATION

Crushed limestone in Florida is transported by truck, rail, and water. Conveyance by truck represents the principle means of transportation and averages between 75 and 85 percent of the total tonnage hauled (U. S. Bureau of Mines, 1945-1974). Rail is an important minor means of transportation of crushed stone and averages from 10 to 15 percent. Due to energy demands and projected future expansion of mass transportation, shipments by rail should increase significantly in the future. Shipment by water is a very minor means of transportation averaging from 0.5 to 2 percent.

QUARRY SITES

Limestone and dolomite in Florida is produced from several formations including the Key Largo Limestone, the Miami Oolite, the Hawthorn Formation, the Tampa Limestone, the Suwannee Limestone, the Marianna Limestone, the Ocala Group, and the Avon Park Limestone (Cooke, 1945). All limestone and dolomite produced in Florida is by open pit mining with the highest concentrations of quarries located in Broward, Dade, and Marion counties.

The production of aggregate (hard-rock) limestone in Florida is primarily concentrated in Broward, Collier, Dade, Hernando, Lee, Monroe,

Okeechobee, Palm Beach, and Suwannee counties (U. S. Geological Survey Investigations, 1973). Dade, Hernando, and Broward counties are, in the order noted, the leading limestone producing counties in the state, supplying 70 percent of the total tonnage and value.

Soft-rock limestone commonly used for road base is more evenly distributed over Florida and averages about 63 percent of the total output of all limestone produced. Figure 1 is a graph showing the number of active quarries (total of hard plus soft-rock) in Florida over the period 1965-1977 (U. S. Bureau of Mines, Mineral Yearbooks 1965-1977). The graph illustrates the wide variation from year to year in the numbers of active quarries. These variations are primarily a result of changing market conditions and quarry suitability.

MARKET TRENDS

The total U. S. production of crushed and broken limestone (excluding that used in making lime) has shown a marked increase over the years. In

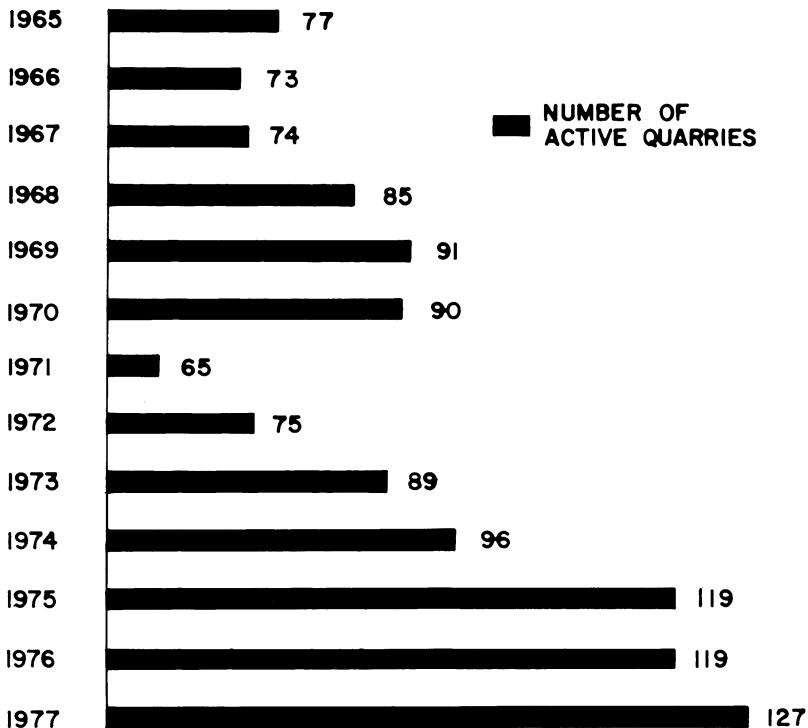


Figure 1.—Number of active quarries producing limestone, dolomite, and coquina in Florida for the period 1965-1977. Numbers represent totals of hard-rock plus soft-rock quarries.

1922 production was 52,684,000 tons; in 1942, 142,025,000 tons; in 1952, 216,468,000 tons; in 1962, 460,953,000 tons, and in 1975 about 666,320,000 tons. This rapid growth over the last 50 years can be attributed to a marked increase in highway construction (especially the development of the interstate system), the building construction industry, and a significant expan-

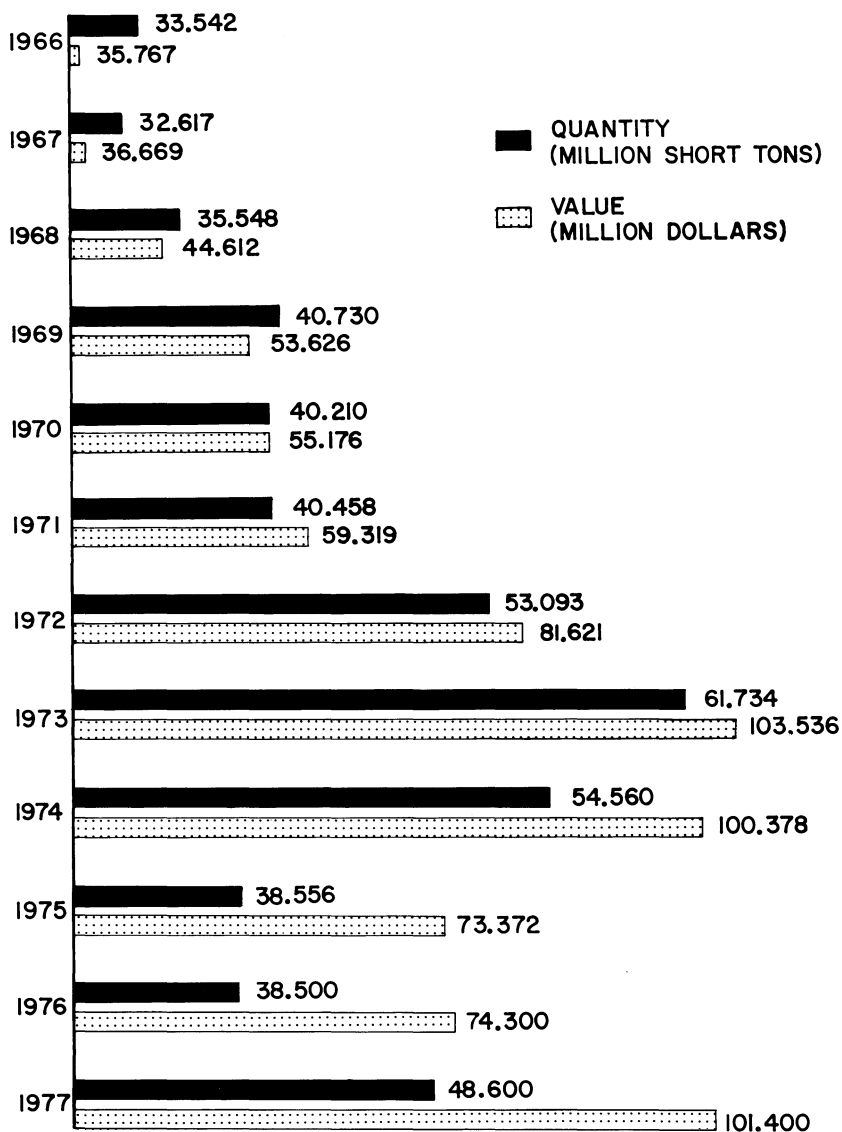


Figure 2.—Production and value for crushed limestone from all sources (limestone, dolomite, and coquina) in Florida for the period 1966-1977.

sion in the metallurgical, chemical, and processing industries for which limestone is an important ingredient. In addition, limestone can be substituted for lime in areas such as agriculture, fluxing, and sulfur removal. This substitution of limestone for lime is further facilitated by the much lower cost of limestone as compared to the more expensive calcined, energy dependent lime.

Figure 2 is a graph showing the record of total crushed limestone production in Florida for the years 1966 to 1977. Production of crushed limestone, which totaled about 33.5 million tons in 1966, rose gradually to a peak of 61.7 million tons in 1973 (U. S. Bureau of Mines, 1966-1976). This steady growth closely paralleled the upward trend in the construction industry during this period of time. The sharp downturn in production recorded in 1974 was directly attributable to a recession and consequent slowdown in the construction and road-building industries. Further reduction in limestone production in 1975 reflected this continued downward trend in the number of homebuilding and highway projects.

ROADBASE AND CONCRETE AGGREGATE

The two principal uses of limestone in Florida are for concrete aggregate and roadbase. Figure 3 shows the trend of this segment of the industry for the period 1966-1975. About 29.5 million tons, 88 percent of the total of Florida's 1966 limestone production, was mined (in 1966) for use as roadbase and concrete aggregate. This can be compared with approximately 33.6 million tons, which is 87.2 percent of the total crushed stone produced in 1975. A comparison of these values shows a relatively small growth for this sector of the industry over this ten-year interval, reflecting in part the recession of 1973-1974 in homebuilding and road construction.

AGRICULTURAL LIMESTONE

Agricultural limestone, which includes both pure limestone and dolomitic limestone, represents a small but significant part of the Florida crushed limestone industry. Figure 3 graphically depicts the fluctuations of this commodity over the period 1966-1975. Use of agricultural limestone here is for fertilizers, soil conditioners and correctives for soil acidity. About 880,000 tons, 2.6 percent of the total limestone production in 1966, was utilized for agricultural limestone. This can be compared with 1975 production figures of 942,000 tons, representing 2.4 percent of the total crushed limestone produced that year.

LIME

Florida lime production in 1965 was 425,000 tons as compared to a total of 199,362 tons in 1975. Figure 4 shows Florida lime production from 1968

to 1977. Total lime production for 1977 in the U. S. and Puerto Rico was 20 million tons, which showed a 1 percent decrease from 1976 and 8 percent below the production level of 1974. Florida lime production represents a figure far below lime consumption in the state.

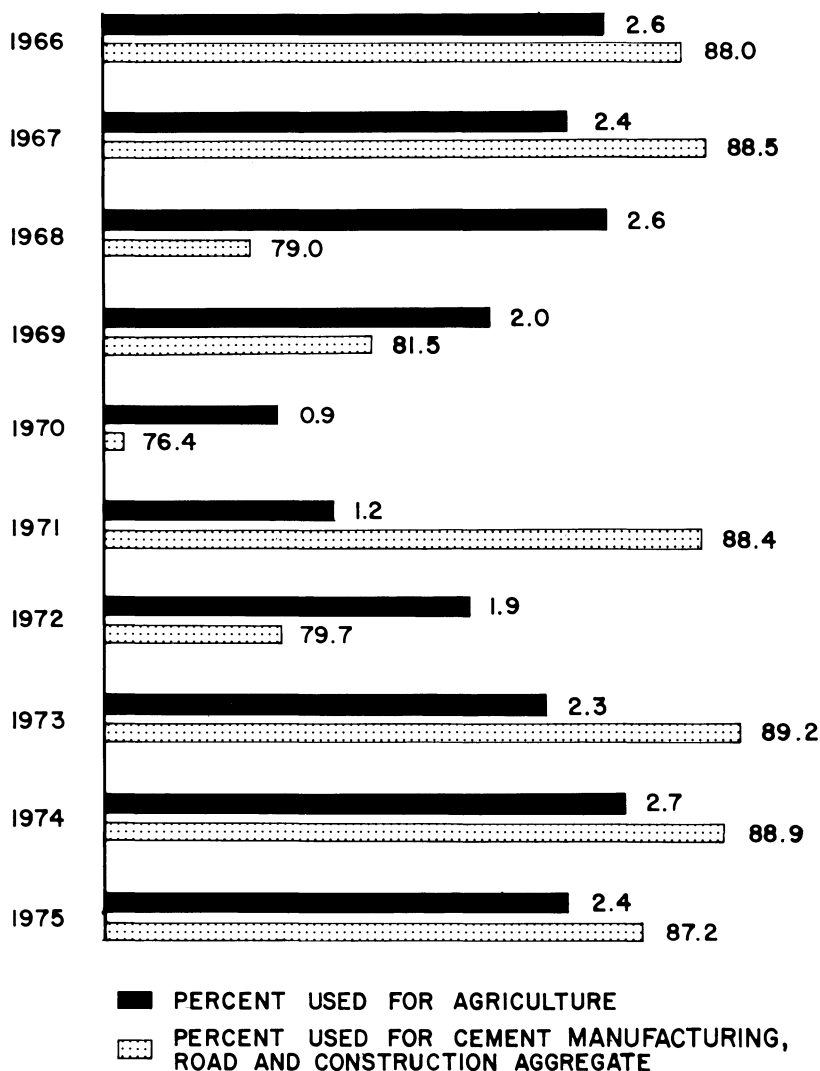


Figure 3.—Percentages of total Florida limestone that are used for agriculture and for cement, road, and construction aggregate for the period 1966-1975.

In June of 1978, the national demand for fluxing lime declined some 15 percent due in a large part to the problems of the U. S. steel industry and foreign steel competition (Boynton, 1978). The curtailment of steel production has had an adverse effect on the lime industry in the east. However, Florida and the rest of the southeast, where sales of fluxing lime are minimal, have experienced an increase in production as a result of increased demand for road stabilization uses, environmental uses, and other chemical-lime markets.

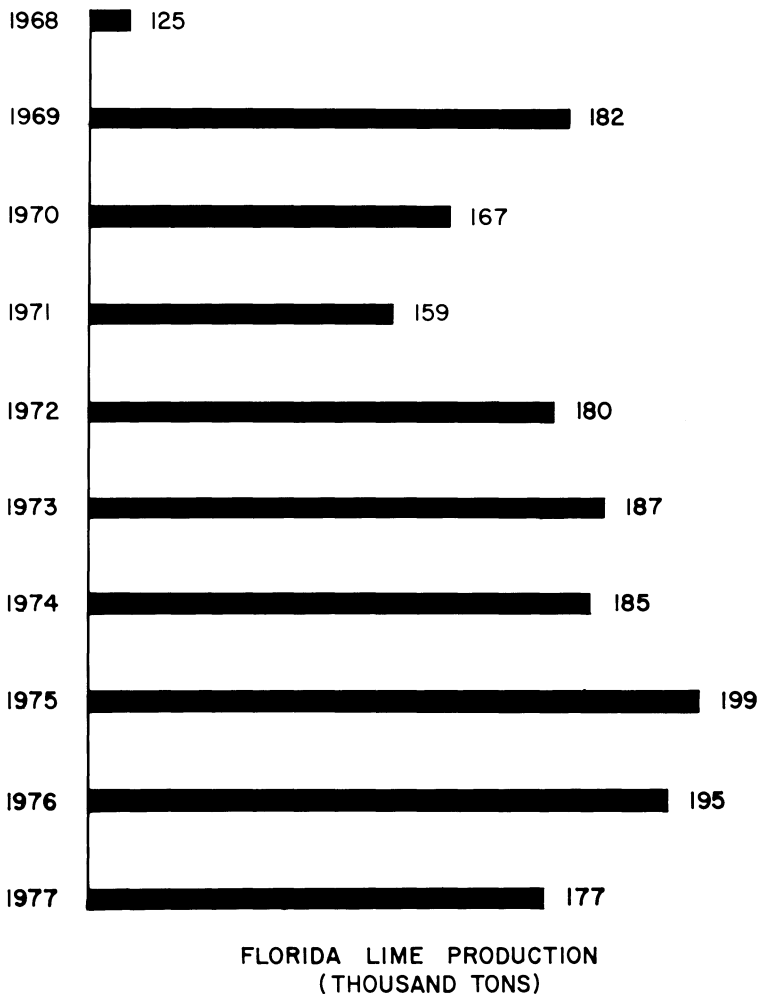


Figure 4.—Florida lime production for the period 1968-1977.

GENERAL FUTURE TRENDS

Virtually all of the crushed stone in Florida is limestone. Nationally the prominence of crushed limestone as an aggregate is reflected in statistics which show limestone accounting for almost 75 percent of the total crushed stone production.

Cement and crushed stone are integral parts of the construction industry, and demands for them closely parallel changes in this part of the economy. Homebuilding, which peaked in October 1977 at an annual rate of 2.2 million new starts, has continued at an annual rate of 2.0 million through 1978 (Carter, 1979). The National Crushed Stone Association sees continued gradual growth for the homebuilding and commercial construction industries through the foreseeable future, and the demand for limestone aggregate and cement should parallel this growth.

Roadbase and concrete aggregate usage in public highway construction should show a moderate increase due to the national goal of completing the interstate system in Florida, as well as other areas of the country. In addition, reconstruction, rehabilitation, and resurfacing projects should continue to increase due to the high level of road usage which results in the continued deterioration of the nation's existing road system.

Due to the world's expanding population and consequent need for higher yield crops, the use of limestone for agricultural limestone is projected to be an area of substantial growth. Nationally, the use of agricultural limestone has shown an average annual increase of nearly 18 percent from 1973 to 1976. This recent growth has been attributed to several factors, including the higher cost of other chemical fertilizers, and the general acceptance by farmers of the importance of liming. The future outlook is for continued growth, but at a more modest rate (Koch, 1979).

In recent years, limestone has experienced an expanding role in the environmental field. One new environmental application is in the area of flue-gas desulfurization. As power plants install scrubber systems, crushed limestone will be needed to charge them. As new and stricter environmental standards are required this market should experience substantial growth in the years ahead (Gutschick, 1979). For example, it is estimated that 600,000 tons of limestone per year will be needed for SO₂ removal in the Lakeland area (Personal communication, J. L. Eades). Other environmental uses with growth potential include the application of limestone for erosion control and waste water treatment.

Some current minor uses of crushed limestone should show moderate growth in the future. For example, the need for railroad ballast should increase substantially in the future due to an increasing national dependence on mass transportation. In addition, it is probable that new industrial and chemical applications of limestone will be found which will contribute to the further growth of this segment of the industry.

ECONOMIC FACTORS

The success of a crushed limestone operation is dependent on a number of factors including market distance, quarry and plant locations, availability of transportation, accessibility, power, reclamation costs, and land values. More recently, factors such as inflation and environmental requirements have had a significant impact on this industry.

Cost factors are especially critical in the crushed limestone industry due to the small profit margin associated with this relatively low priced, high volume commodity. For example, with today's rising fuel costs a long truck or rail haul may be prohibitive, thus requiring quarries to be relatively near to the consumer. Direct costs now average about \$1.35 to \$1.75 per ton, and truck haulage adds \$.15 to \$.25 per ton for the first mile and \$.05 to \$.10 for each additional mile.

An additional factor is the aggravation to the urban population centers from dust, noise, and blasting. As the urban areas expand, active quarries and potential quarry sites are encroached upon. Consequently, the conflicting interests of continued urban growth and the development of limestone quarries are major considerations to the industry.

The upward spiral in land prices will continue to be an important economic consideration in the production of crushed limestone. Adequate property must be purchased or leased economically for future expansion of the quarry, as well as space for processing plant, storage, and waste disposal facilities. It is estimated that Florida's limestone reserves total some 85 billion tons, of which 32 billion tons are readily available for mining (U. S. Geological Survey Investigations, 1973). Much of the remainder is unavailable for reasons of urban encroachment or excessive overburden thickness.

Another major factor affecting the production of limestone in the future is the price of energy. The ever-rising costs of energy, labor, and materials will continue, thereby increasing the price of limestone. In addition, the recent increase in the minimum wage and a new tougher Mine Health and Safety Act should also contribute to higher prices (Carter, 1979).

Other measures either pending in Congress or under serious consideration affecting this vital industry include: sharp increases in social security taxes on employee and employers, additional taxes to industrial users of energy in the form of wellhead taxes, peak hour utility rates, requiring the conversion of oil and gas operation to coal, a reduction or elimination of percentage depletion allowances, and the application of strict coal mine requirements to the stone industry. A large potential factor affecting the production of limestone is more restrictive EPA standards which would significantly reduce the mineral particle content in ambient air at production sites, thus restricting the uses of unbound crushed stone. These EPA standards would require that a minimum of 99.85 percent of the dust

generated at a lime plant would be collected, or a maximum emission of 0.3 lb/ton and an opacity of no more than 10 percent (Carter, 1979). A continuous monitoring program would ensure compliance. The effect of such restrictions could seriously limit plant expansion, according to the National Lime Association.

In summary, the future outlook for the limestone industry in Florida is bright, especially in areas of environmental application, construction, and agriculture. The National Crushed Stone Association estimates a slow but solid expansion of production through 1979 in Florida and a 2 to 3 percent national annual rate increase.

MINING METHODS AND BENEFICIATION

MINING METHODS

There is considerable variation among the sizes of mining operations in the state. At one end of the scale are "backyard operations", with one man and a tractor digging a small pit and selling the material locally. At the other end of the scale are the huge operations that encompass several square miles of holdings and produce several commodities simultaneously from the same pit. They have plant facilities to completely process the commodities, and their products are sold internationally.

Market conditions will determine the scope of a company's operations; that is, how much raw material must be mined in order to get as much finished product as can be sold? The projected scope of operations, then, will determine the type and size of mining and processing equipment needed. Other important determinants of required equipment are the kinds of materials to be mined, and the geological conditions where the quarry is to be located.

All limestone, dolomite, and coquina mining in Florida is by the open pit method. Almost without exception, it is necessary to remove overburden before mining can proceed. Usually, the overburden consists of quartz sand with widely varying amounts and combinations of other constituents, such as clay, silt, organic materials, shells, phosphorite, and heavy minerals. The maximum thickness of overburden tolerated is 20-25 feet; most mines are located where there is less than that. The overburden is stripped off by dragline or bulldozer and stacked near the excavation. However, if the overburden is an important commodity that can be sold, it may be processed and transported away from the quarry. Good examples of saleable by-products are sand, clay, or peat.

Mining operations can be classified generally as wet versus dry pits, and hard versus soft rock. The easiest mining conditions occur in soft-rock, dry-pit operations. The most difficult conditions occur where hard rock must be

mined from underwater. Soft, dry rock can be mined with bulldozers or front-end loaders that simply "rip" the working face. In dry pits, the rock may be loaded onto trucks or conveyors and taken directly to the processing plant; or it may be crushed and then hauled to the plant. Where pits are flooded, mining is done by dragline. The broken rock is removed and either stacked to dry for later hauling to the plant, or it may be crushed and then moved to the plant. For harder rocks it first may be necessary to blast them into manageable sizes, before transport or crushing. This entails a separate operation, in which shot-holes are drilled into the rock and explosives are placed and detonated.

PROCESSING AND BENEFICIATION

Processing involves operations which physically or chemically change materials on their way to becoming finished products.

The most common uses of limestone, dolomite, and coquina are as crushed stone or aggregate products. The crushed stone is the basic raw material that can be processed further, if necessary, for roadbase, cement manufacture, fertilizer and soil conditioners, rip rap and other uses. Market conditions or customer specification, of course, will determine the necessary degree of processing.

Processing of limestone and dolomite mostly involves size reduction and invariably includes crushing and screening (size grading). These processes produce the different sizes of stone that are the raw materials required in subsequent uses. Some small mining operations may be able to utilize the simplest of machines, such as a portable, one-step crusher/screener, illustrated in Figure 5. Larger mines require more elaborate, multi-stage systems, with each successive stage producing finer-sized material. Figure 6 is a simplified block diagram of a multi-stage processing plant for crushed stone. Examples of these processing methods and equipment are shown in Figure 7.

Screening processes allow for the removal of properly sized fractions from the system, and for coarse fractions to be recycled for further crushing. As indicated down the left side of Figure 6, the crushing and screening techniques allow for the removal of different size fractions of stone at intermediate stages. After sufficient crushing and screening the stone may be transferred to storage, or loaded directly onto trucks, rail cars, or barges for delivery to customers.

For some uses it may be necessary to do more to the stone than reduce its size. Such processes can involve beneficiation techniques. Beneficiation is any process which removes unwanted components from the raw material, or which adds relatively pure desirable components to the raw material. Washing, screening, drying, and blending are the most common beneficia-

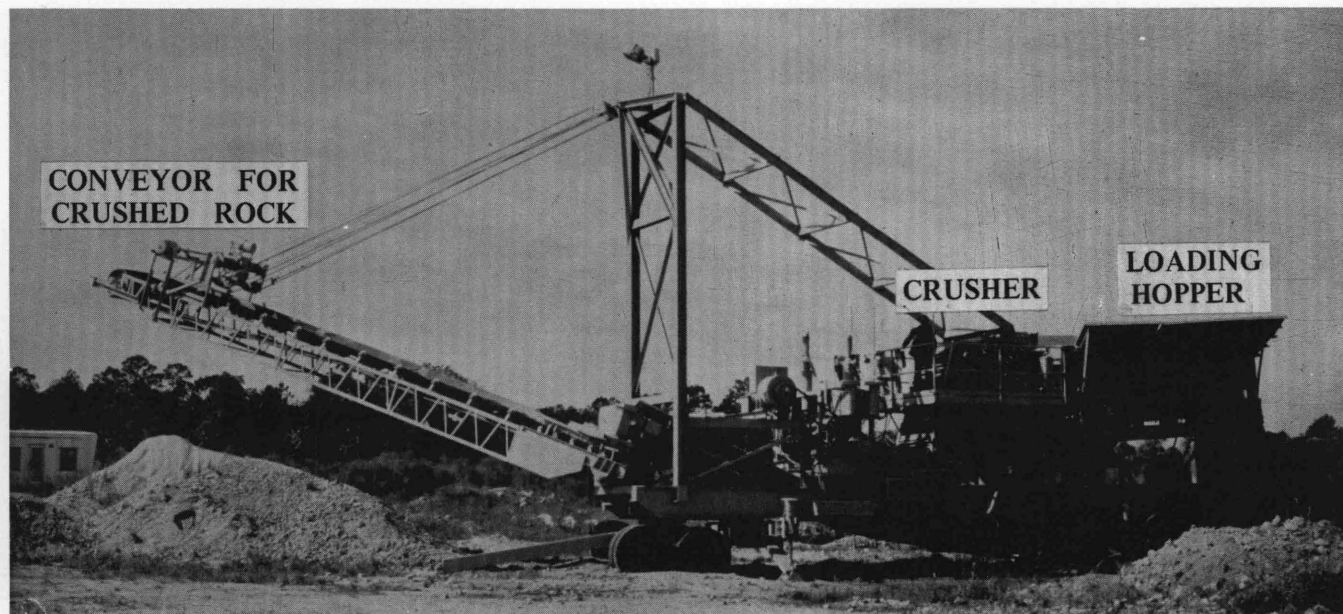


Figure 5.—One type of portable rock crusher used in quarries. Man at crusher controls gives scale.

tion processs used for limestone, dolomite, and coquina. A special beneficiation of limestone, in the form of pyroprocessing (commonly called burning), is required to manufacture Portland cement. Because cement manufacturing is such a specialized, high consumptive user of limestone, it will be discussed separately.

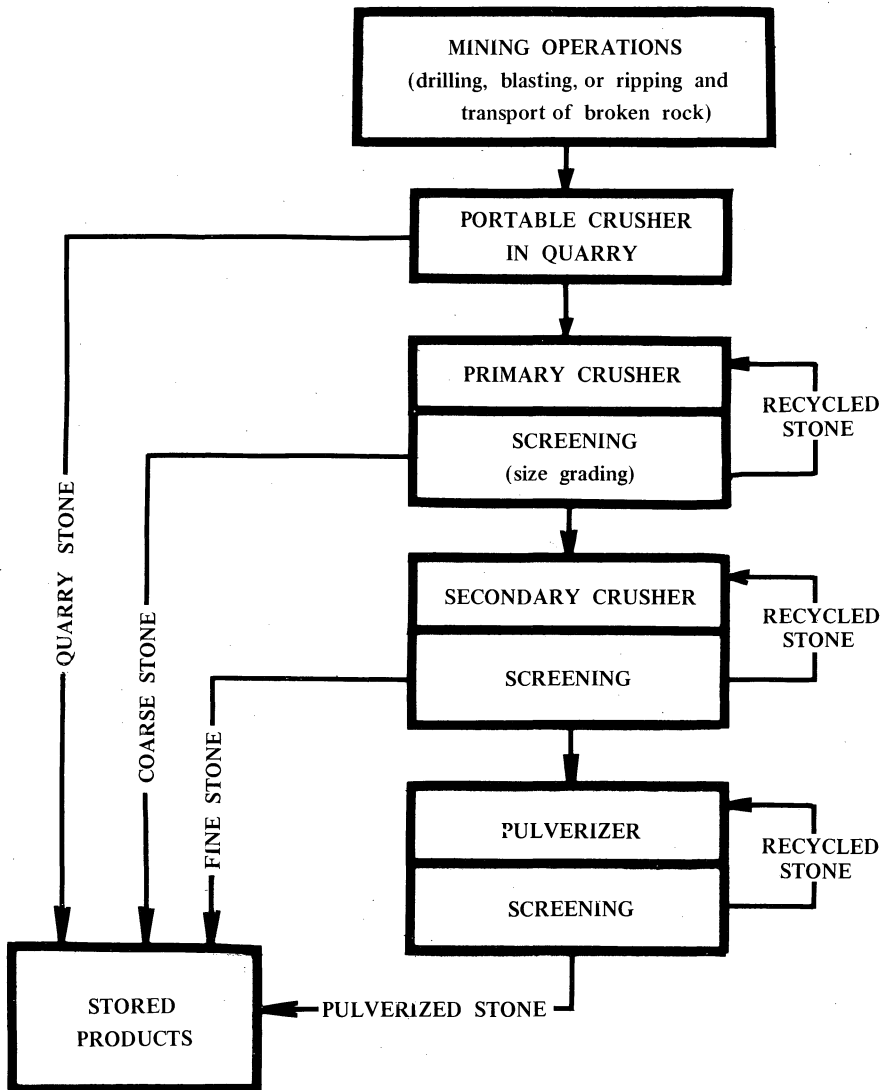


Figure 6.—Simplified processing diagram for limestone, dolomite, and coquina. Some mining operations may have either more or fewer steps.

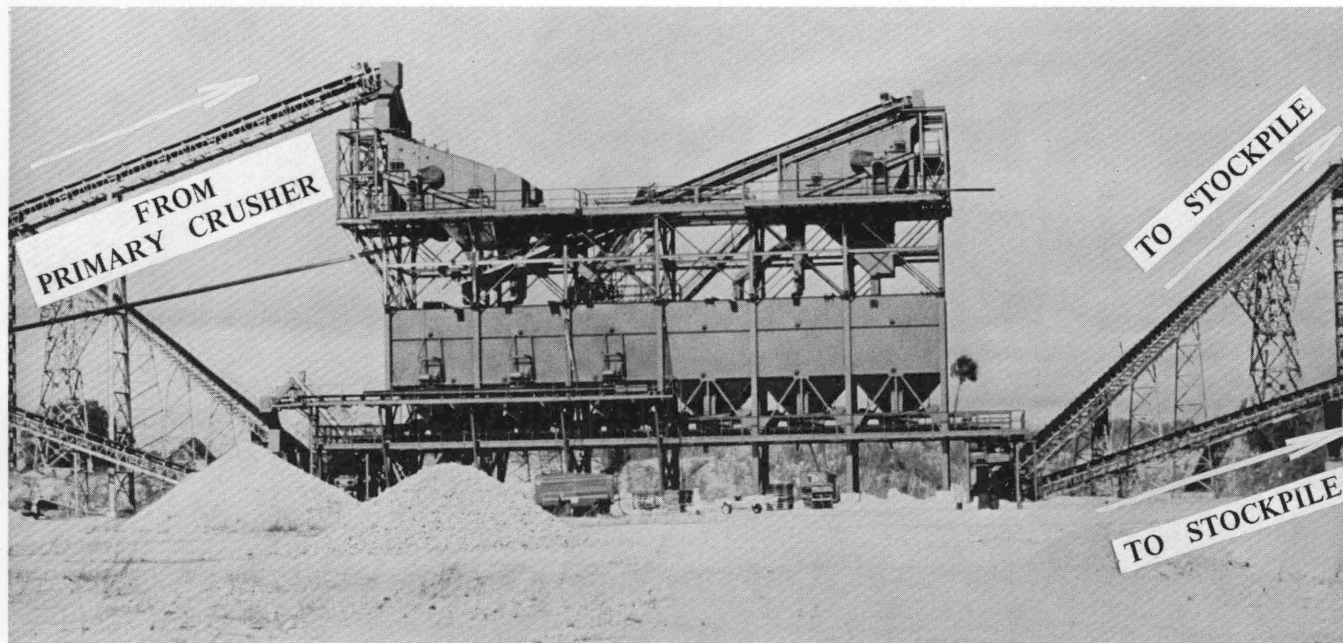


Figure 7.—A multi-stage crusher/screener plant that can produce and separate several sizes of stone. The large hoppers store the various fractions of stone, which also can be shunted to stockpiles by several outrigger conveyors. Trucks can be loaded beneath the hoppers and at the stockpiles.

CEMENT MANUFACTURING

The manufacture of Portland cement (hereafter called cement) is the processing of selected raw materials to produce a synthetic "clinker", which can be processed further to give a "raw cement" mix to meet the specifications of the customers. In the discussion that follows, reference is made to Figure 8, which is a schematic diagram of the flow-process of materials through a modern "dry process" cement plant. Corresponding photographs of major equipment found in such a plant are shown as Figures 9-13.

The technology of cement manufacturing has undergone significant changes over the last 20 to 30 years. Older plants were more energy intensive, while modern plants are designed to be energy conservative. An example of this is shown on Figure 8, where hot gases from the exit of the kiln are recycled to several prior stages. Process control and its corollary, quality control, have improved due to automation and computer monitoring of processes. Because of these technological advances, some large modern cement plants are designed to operate with less than 10 men. Most older cement plants use a "wet" process, whereby all grinding, blending, and conveying are done with wet slurries. Recent upward spirals of fuel costs have led to the design of energy saving "dry" process plants, where emphasis is on keeping moisture content low. But, because of other economic considerations, converting from wet to dry plants may not be justified. Therefore, depending on any given company's requirements and plant design, specific equipment may vary from that shown here. In all cases, however, the basic cement manufacturing process is as described.

Cement manufacturing combines mechanical and chemical processes. All steps prior to the "rotary kiln" are mechanical, and their functions are to prepare the raw materials into a form that is suitable for "feed" to the kiln. The kiln is a high-temperature pyroprocess that chemically combines the raw materials to form a "clinker".

Cement compounds differ in chemical makeup according to end-product specifications, but generally they range from Ca_3SiO_5 , through $\text{Ca}_4\text{Al}_2\text{Fe}_2\text{O}_{12}$ (Lefond, 1975). The primary ingredient of cement is lime (CaO). Cement manufacturing requires large quantities of lime, which is obtained from calcium carbonate minerals (CaCO_3). In Florida, manufacturers' sources of calcium carbonate are limestones. In the past, deposits of sea shells were mined, but that source of calcium carbonate is no longer used in the state. Limestone that is relatively soft and of high purity is the most desirable, since these two attributes decrease the amount of processing necessary, as well as reducing the cost of manufacturing.

Secondary raw materials needed in cement manufacturing are silica, alumina, and in some cases, iron. Sources of these raw materials may be natural or artificial. In Florida, natural sources of these materials are sand,

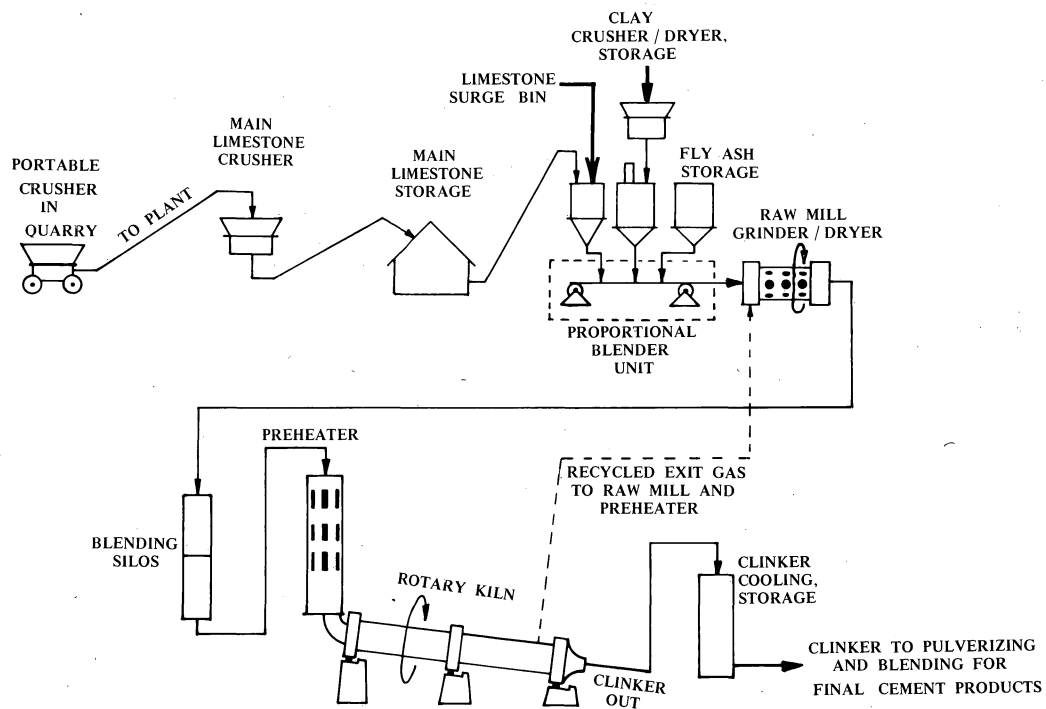


Figure 8.—Schematic diagram of the flow-process of materials through a modern “dry process” cement plant.

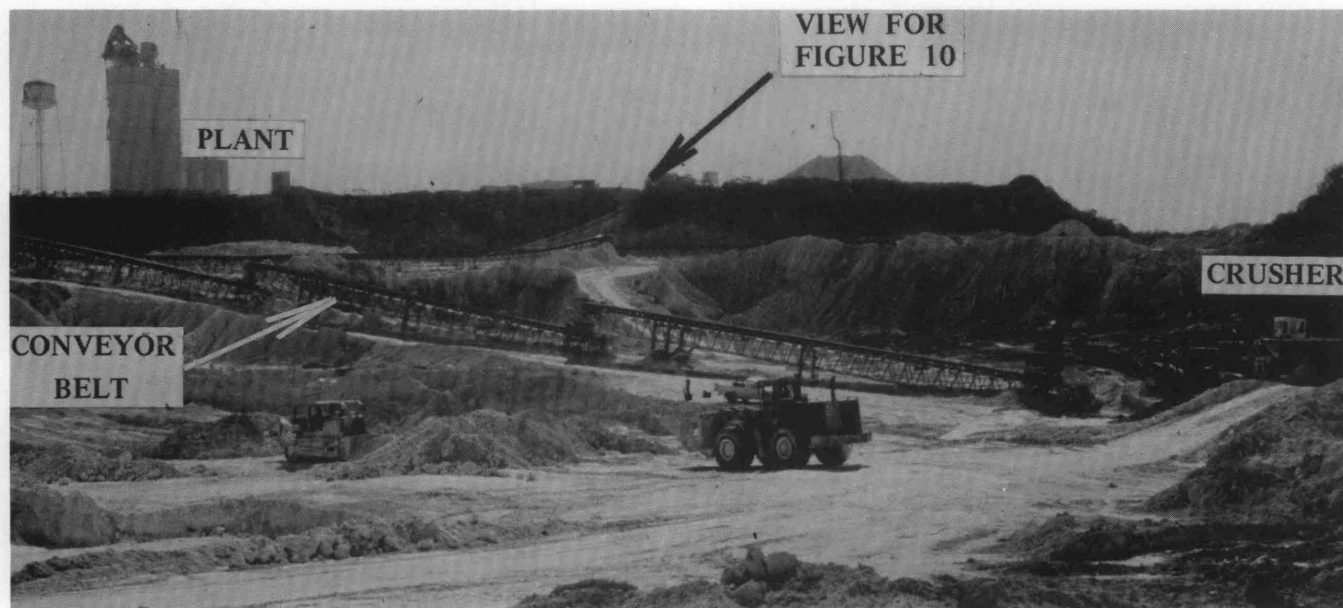


Figure 9.—View of a dry-pit limestone quarrying operation. The rock is ripped and stacked by a bulldozer. The front-end loader feeds the portable crusher, and the crushed rock is then carried to the plant on the conveyor belt. (Picture used with permission of Florida Mining & Materials Corp., Brooksville.)

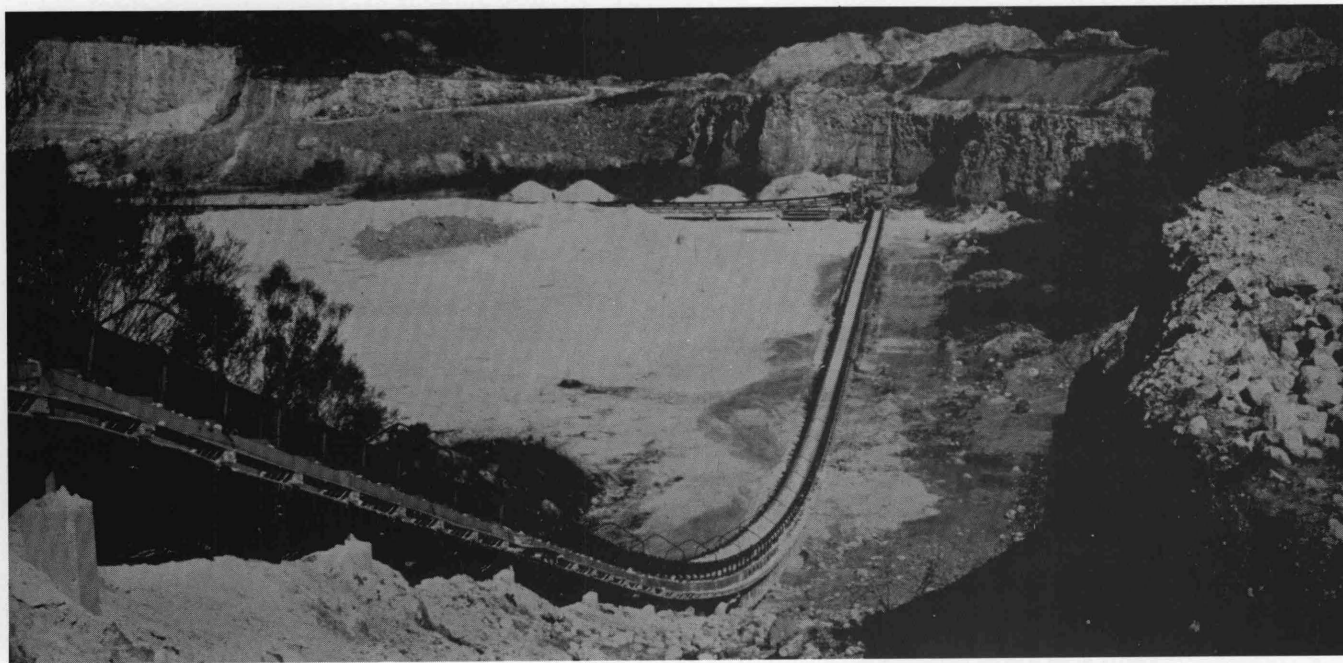


Figure 10.—Conveyor belt from quarry to plant (Picture used with permission of Florida Mining & Materials Corp., Brooksville.)

staurolite or clay; artificial sources are slag or fly ash. If natural deposits of these additives do not occur on the plant property, it is necessary to purchase them from outside sources. Fly ash is an example. This material, which is a waste by-product of coal burning electrical utilities' generating plants, is an excellent source of additives.

As with limestone and coquina processing, cement manufacturing in Florida begins with quarrying operations. These operations are discussed above, and they are applicable here up to the point where the crushed limestone enters the cement plant.

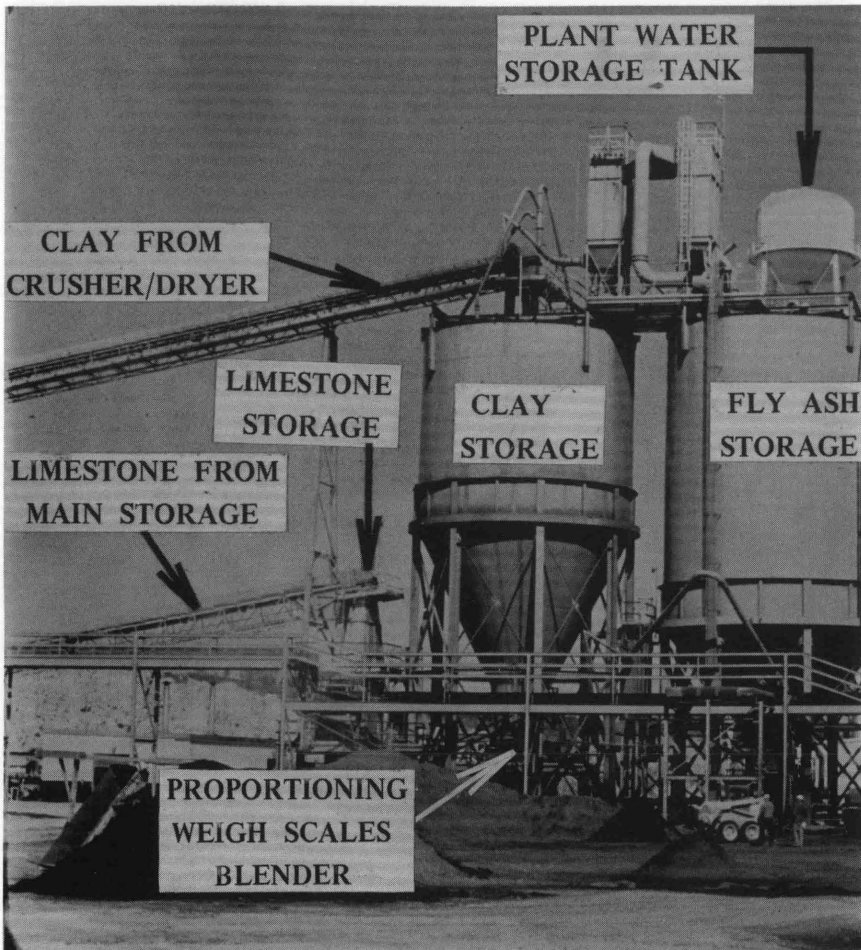


Figure 11.—Proportional blender unit. Surge storage bins for limestone, clay, and fly ash. (Picture used with permission of Florida Mining & Materials Corp., Brooksville.)

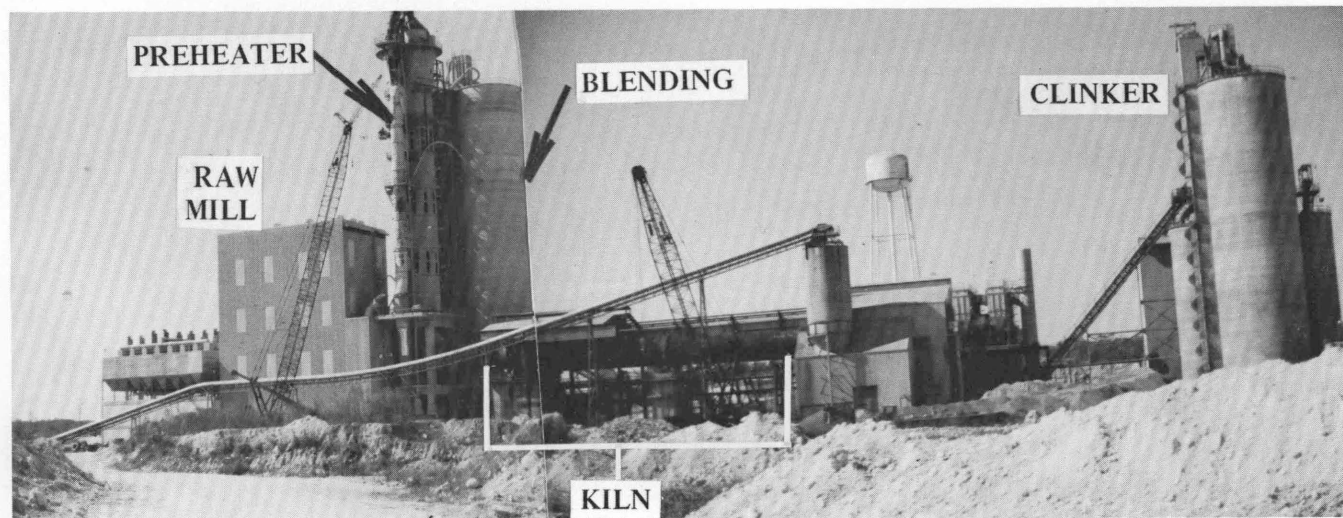


Figure 12.—Panoramic view of cement plant showing, from left to right: rotating raw mill (grinder/dryer), kiln-feed preheater and blending/storage silos, rotary kiln, and clinker storage silos. (Picture used with permission of Florida Mining & Materials Corp., Brooksville.)

After one or more stages of crushing, the limestone is stockpiled, where it is available as raw feed according to the demands of the plant. If clay is used as an additive, the plant may have a clay crusher/dryer, whose output is conveyed to storage. Other raw materials, such as fly ash, are stored separately.

All of the raw materials are brought together at the proportional blender unit. This unit consists of weigh-scales and belt conveyors. The central control room controls the proportions (by weight) of each raw material that is released from storage and blended. This blend is conveyed to a rotating raw mill, which performs the dual functions of grinder and dryer. Some of the hot gases from the kiln are recycled to the raw mill to dry the mix. Grinding is accomplished by steel balls in the rotating mill.

This raw mix is sent to the kiln preheater/blender, which is the final mechanical step in preparing the "feed" for the kiln. Using recycled hot gases from the kiln (about 1800° F), the raw mix is preheated before being fed into the kiln. This step increases the efficiency of the kiln by having the initial large heat exchange take place outside the kiln. This increased efficiency allows the use of a considerably shorter kiln. This last item, the size

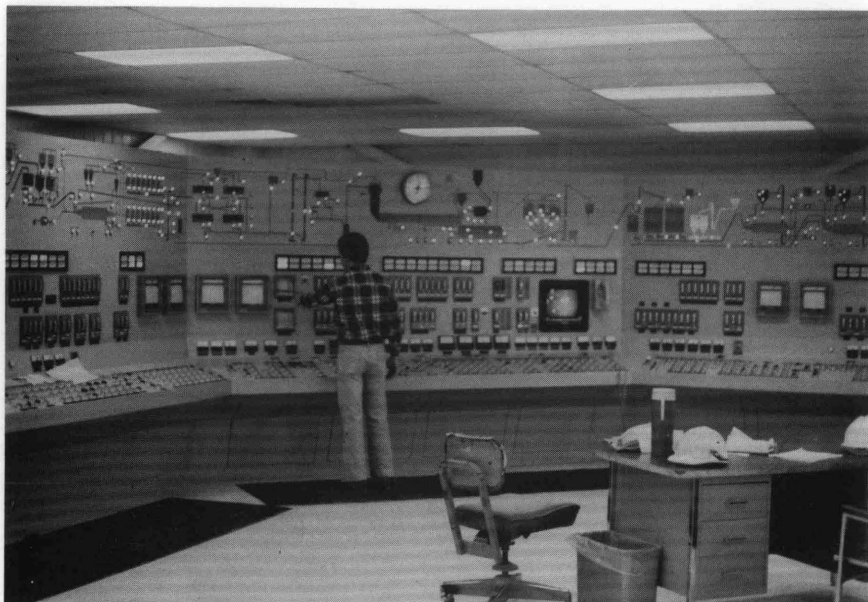


Figure 13.—Main control room of cement plant showing, from top to bottom: illuminated process flow diagram, automatic process control instruments with alarms, sloped panel with operator's controls. The TV screen in the center monitors the clinker as it leaves the kiln. (Picture used with permission of Florida Mining & Manufacturing Corp., Brooksville.)

of the kiln, is substantial in terms of both investment and physical dimensions. Until recent years, the trend in the cement industry was to bigger kilns - the largest in the United States being over 600 feet long and 25 feet in diameter. Today, with the emphasis on energy conservation, the trend is to smaller and more efficient kilns, with overall dimensions reduced by 30 to 60 percent from that mentioned above.

The kiln is the center of the cement plant. All processes up to this point have been to get the raw materials into proper size and proportions, so that the kiln can burn them to form the artificial cement "clinker". The kiln is very slightly inclined so that it slowly moves the feed down its length as it rotates. Temperature increases toward the exit end, where it can be as high as 2700° F. The high temperature produces several physical and chemical changes in the raw feed. Physically, the material is melted and fused. The most important chemical changes are calcination, which drives off carbon dioxide gas (CO_2) from the limestone to form lime (CaO), and subsequent reactions of the hot lime with the additives of silica, alumina, and iron to produce a synthetic silicate "clinker". The clinker products are cooled and stored for further processing, which usually includes pulverizing and blending with other additives to meet customer specifications.

MINERAL PRODUCERS

The following list of active and inactive limestone, dolomite, and coquina producers was compiled from many sources, the main ones being the U. S. Bureau of Mines, the Mine Safety and Health Administration, and the Florida Department of Transportation. A telephone survey was conducted for those producers whose mine location was uncertain. Because of the nature of the mining industry, the location and sometimes the operational status of the producer changes, and therefore the list is only accurate as of the time the survey was made. Any updates to this list are requested and should be sent to the Bureau of Geology, 903 West Tennessee Street, Tallahassee, Florida 32304. The compiler of this list is indebted to the members of the Florida stone industry and the above agencies for information supplied on the industry in Florida.

The list is divided into active and inactive producers. Within these categories the list is further divided into commodity, county, and producer. The counties and then the producers in each county are listed alphabetically. All of the active producers' locations are plotted on the resource potential maps located in the pocket at the back of this publication.

The inactive producers list is not to be considered exhaustive, as it is virtually impossible to locate all the inactive operations in the state. Some inactive producers locations are known only by county with no information on their exact locations. The addresses given for the producers that have ceased operations are given for historical purposes only.

ACTIVE MINERAL PRODUCERS LISTED BY COMMODITY AND COUNTY

Company Name/Address	Mine Name	MINE LOCATION		
		Township	Range	Section
LIMESTONE				
ALACHUA				
Houdaille Duval Wright Corp. P. O. Box 1588 Jacksonville, FL 32201	Haile Quarry Chastain Pit	9S 9S	17E 13,14,23,24 18E	 18
Limerock Industries, Inc. P. O. Drawer 790 Bronson, FL 32621	Newberry Pit	9S	17E	25
Limestone Products, Inc. P. O. Box 177 Newberry, FL 32669	Haile Quarry North Pit North Pit Cleary Pit	9S 9S 9S 9S	17E 17E 18E 17E	24 13,24 18-20 26
S. M. Wall Co. 1650 N. E. 23rd Blvd. Gainesville, FL 32601	High Springs Mine	7S	18E	30
BROWARD				
Bergeron Sand and Rock Min- ing Co. 2121 North 184th Ave. P. O. Box 6280 Hollywood, FL 33021	Hollywood Pit	51S	39E	12
BNJ Equipment Corp. 401 Hanchey Drive Nokomis, FL 33555	Broward Rock & Fill Pit	48S	42E	16
Broward Paving, Inc. 2011 North State Road 7 Hollywood, FL 33021	Rhodes Pit	50S	42E	31
A. J. Capeletti, Inc. P. O. Box 9444 Hialeah, FL 33021	Broward Pit No. 1	51S	41E	29
Curcie Brothers, Inc. 2550 Park Road Hallendale, FL 33009	Glades Rock Pit	51S	40E	7
Dimar Industries Hollywood Quarries 3000 SW 64th Ave. Ft. Lauderdale, FL 33314	(No Name)	50S	41E	23
Florida Fill Inc. P. O. Box 560992 Miami, FL 33156	Gator Rock	50S	39E	15

Griffin Brothers Co., Inc. 6143 SW 45th Street Davie, FL 33314	Griffin Brothers Pit	50S	40E	16
Hardrives Paving, Inc. 846 NW 8th Ave. 6143 SW 45th Street Davie, FL 33314	State Road Quarry State Road Quarry	50S 50S	42E 16	19 40E
Hardrives Paving, Inc. 846 NW 8th Ave. Ft. Lauderdale, FL 33311	State Road Quarry State Road Quarry Snake Creek Mine Pit No. 4 Miramar Lakes Pit	50S 50S 51S 48S 51S	42E 41E 39E 42E 39E	19 24 24 9 36
Meekins, Inc. 3500 Pembroke Road Hollywood, FL 33021	Derfield Quarry	48S	42E	4
Miramar Rock, Inc. Box 6418 Hollywood, FL 33021	Miramar Mine	51S	39E	36
L. W. Rozzo, Inc. 4435 SW 26th Street Ft. Lauderdale, FL 33314	Rozzo Mine	51S	40E	31,32
Vulcan Materials S/E Division P. O. Box 80730 Atlanta, Ga. 30366	Broward Mine	51S	39E	24

CITRUS

Carroll Contracting & Ready Mix, Inc. P. O. Drawer 1398 Inverness, FL 32650	Carroll's Lecanto Pit	18S	18E	33
Colitz Mining Co. (Crystal River Quarries, Inc.) P. O. Box 216 Crystal River, FL 32629	Lecanto Rock Pit	19S	18E	15,16
E. R. Jahna Industries, Inc. Lecanto Rock Division P. O. Box 317 Lecanto, FL 32661	Lecanto Mine	18S	18E	15
Lecanto Materials Co. (Crystal Construction Co.) Drawer 291 Lecanto, FL 32661	Lecanto Rock Mine	18S	18E	15

REPORT OF INVESTIGATION NO. 88

37

COLLIER

Ashland-Warren, Inc. P. O. Box 7368 Naples, FL 33941	Golden Gate Quarry	49S	27E	16
A. J. Capeletti, Inc. P. O. Box 9444 Hialeah, FL 33021	Collier No. 1 Quarry	53S	33E	14
Century Industries P. O. Box 4667 Jacksonville, FL	Sunniland Quarry	48S	30E	28
Florida Rock Corp. Box 2037 Naples, FL 33940	Golden Gate Quarry	49S	26E	21
Highway Pavers, Inc. P. O. Box 7098 Naples, FL 33941	Virgil Marcum Pit	50S	26E	7
Meekins, Inc. 3500 Pembroke Road Hollywood, FL 33021	Mule Pen Rock Quarry	48S	26E	13,14 23,24

COLUMBIA

Limerock Industries, Inc. P. O. Box 473 Chiefland, FL 32626	Columbia City Mine	5S	16E	16,17 20,21
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DADE

The Brewer Co. of Fla., Inc. 9800 N.W. 106th Street Miami, FL 33166	Naranja Road Rock Pit	55S	39E	34
A. J. Capeletti, Inc. P. O. Box 9444 Hialeah, FL 33021	Dade Pit No. 1	52S	40E	13
	Dade Pit No. 7	52S	40E	20
	Dade Pit No. 9	53S	39E	26
	Dade Pit No. 10	53S	39E	23
	Dade Pit No. 11	53S	39E	21
	Dade Pit No. 12	55S	39E	13,14
	Dade Pit No. 13	52S	39E	13
Coral Aggregates Corp. Division of Meekins 3500 Pembroke Road Hollywood, FL 33021	Miami Mine	53S	39E	36
Lowell Dunn Co. P. O. Box 2577 Miami, FL 33012	Dunn Airport Pit	52S	39E	2
	Indian Lakes Pit	54S	40E	16
Florida Rock and Sand Co. P. O. Box 3004 Florida City, FL 33030	Card Sound Pit	58S	39E	17

General Portland Inc. Florida Division Box 440336 Miami, FL 33144	Dade County Quarry	54S	38E	36
A. J. House and Sons, Inc. P. O. Box 457 Miami, FL 33144	Pit No. 1	53S	39E	13
Lone Star Florida, Inc. 6451 N. Federal Highway Fort Lauderdale, FL 33308	Pennsuco Quarry Pennsuco Quarry	52S 53S	39E 39E	26,35,36 2
Miami Crushed Rock, Inc. P. O. Box 440214 Miami, FL 33166	Coral Gables Quarry	53S	39E	25,36 Gov. Lot1
Redland Construction Co. 9800 N.W. 106th St. Miami, FL 33166	Brewer Pit	55S	39E	27,34
Redland Rock Co. 23799 S. W. 167th Ave. Homestead, FL 33030	Eureka Pit	55S	39E	34
Rinker Southeastern Materials, Inc.	F. E. C. Quarry (No Name)	52S 52S	39E 40E	25 31
P. O. Box 2634 Miami, FL 33012	Rinker Lake Quarry Miami Quarry	52S 53S	40E 39E	20 34
Ronlee, Inc. P. O. Box 660655 Miami Springs, FL 33166	Ronlee Inc. Pit	52S	39E	12
Sterling Crushed Stone Co. Box 630877 Ojus Branch Miami, FL 33163	Richmond Quarry Golden Prince Quarry	55S 53S	39E 39E	24 25
Vulcan Materials Co. S/E Division P. O. Box 80730 Atlanta, Ga. 30366	Medley Plant	53S	40E	5,9
West Dade Rock & Fill Co., Inc. (Marks Brothers Co.) 1313 N. W. 97th Ave. Miami, FL 33126	West Dade Rock Pit	53S	39E	26

DIXIE

Anderson Contracting Co., Inc. P. O. Box 38 Old Town, FL 32680	Tennille Pit	8S	10E	27
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HENDRY

LaBelle Limerock Co. General Delivery LaBelle, FL 33935	LaBelle Limerock Mine	43S	28E	13
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REPORT OF INVESTIGATION NO. 88

39

L. T. Ridgill & Sons P. O. Box 447 Clewiston, FL 33440	Clewiston Quarry	43S	34E	24
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HERNANDO

Brooksville Rock Co., Inc. 605 W. Broad St. Brooksville, FL 33512	Broco Quarry	21S	18E	23
W. L. Cobb Construction Co. P. O. Box 11826 5002 E. Hillsborough Ave. Tampa, FL 33610	Aripaka Quarry	23S	17E	19
Florida Crushed Stone Co. P. O. Box 668 Brooksville, FL 33512	Brooksville Gay Quarry	21S	19E	31,32
	Brooksville Gay Quarry	22S	18E	1,12
	Brooksville Gay Quarry	22S	19E	5-8,18
Florida Rock Industries, Inc. P. O. Box 457 Brooksville, FL 33512	Diamond Hill Mine	21S	19E	20
E. R. Jahna Industries, Inc. P. O. Drawer 317 Lecanto, FL 32661	Mills Mine	23S	21E	1

LAFAYETTE

Anderson Contracting Co. P. O. Box 38 Old Town, FL 32680	Dowling Park Pit	3S	11E	6
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LEE

Ballard Shell & Fill, Inc. Rt. 2, Box 1104 North Ft. Myers, FL 33903	Ballard Pit	44S	23E	10
Coral Rock Industries, Inc. P. O. Box 1021 Cape Coral, FL 33904	Cape Coral Pit	43S	24E	17,18 19,20 (mining canal spoil banks)
Florida Rock Industries, Inc. P. O. Box 158 Ft. Myers, FL 33901	Alico Road Pit	46S	25E	1,12
Fugate Construction Co. 137 Texas Ave. Ft. Myers, FL 33901	Alva Mine	43S	27E	10
Harper Brothers, Inc. Route 13, Box 821 Ft. Myers, FL 33901	Estero Quarry	46S	25E	7
J. L. Kelly Rock Co., Inc. P. O. Box 353 LaBelle, FL 33935	Alva Pit	43S	27E	11,14

BUREAU OF GEOLOGY

LEVY

Connell & Schultz Box 97 Inverness, FL 32650	Williston Quarry	12S	19E	31
Levy County Road Dept. P. O. Box 336 Bronson, FL 32621	Arrington Pit Williston Pit Grissin Pit	10S 13S 13S	15E 18E 14E	31 12 4
V. E. Whitehurst & Sons, Inc. Route 1, Box 125 Williston, FL 32696	Raleigh Quarry	12S	19E	19,20

MARION

Lecanto Materials Co. (Crystal Construction Co.) Drawer 291 Lecanto, FL 32661	Britt (Ocala) Pit	16S	22E	20
Marion County Highway Dept. 3190 S. E. Maricamp Road Ocala, FL 32670	(No Name) Canal Right of Way Pit Bell Pit Godwin Pit	14S 16S 12S 14S	22E 22E 21E 20E	6 15 34 1
Monroe Rock Co. P. O. Box 417 Belle View, FL 33626	Zuber Pit Pedro Mine Barco Pit	14S 17S 15S	21E 22E 20E	18 24 19
Ocala Limerock Corp. Box 1060 1013 N. E. Osceola Street Ocala, FL 32670	No. 7 Kendrick Quarry Zuber Pit	14S 14S	21E 21E	23 14
O'Neal Construction Co. 5685 S.W. 52nd Street Ocala, FL 32670	O'Neal Pit	14S	21E	25,36
Southern Materials Corp. P. O. Box 218 Ocala, FL 32670	Lowell Quarry	13S	21E	23
M. J. Stavola Industries, Inc. P. O. Box 187 Anthony, FL 32617	Stavola Pit	14S	22E	19

MONROE

Parks Banks Trucking P. O. Box 327 Rockledge, FL 32955	Big Pine Key Quarry	66S	29E	25
A. J. Capeletti, Inc. P. O. Box 9444 Hialeah, FL 33021	Monroe Pit No. 1	60S	40E	29
Alonzo Cothron, Inc. P. O. Box 450 Big Pine Key, FL 33043	Tavernier Pit	62S	39E	6

REPORT OF INVESTIGATION NO. 88

41

Charley Toppino & Sons, Inc. Box 787 Key West, FL 33041	Rockland Key Quarry	67S	26E	21
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PASCO

Belcher Mine, Inc. P. O. Box 86 Aripeka, FL 33502	Belcher Mine	24S	16E	1,2 11,12
International Minerals and Chemical Co. Box 867 Bartow, FL 33830	Morrel Limerock Mine	25S	22E	24,25

ST. LUCIE

Florida Rock Industries P. O. Box 4667 Jacksonville, FL 32201	(No Name)	37S	38E	15
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SUMTER

Dixie Lime & Stone Co. Suite 700, Lincoln Center Tampa, FL	Sumterville Complex	20S	22E 23E	1,12,13 6,7
Florida Crushed Stone Co. 303 E. Silver Springs Blvd. P. O. Box 608 Ocala, FL 32670	Center Hill Quarry	21S	23E	16
Ocala Limerock Corp. Box 1060 1013 N. E. Osceola St. Ocala, FL 32670	Mabel Quarry	22S	23E	10,11
St. Catherine Rock Co. Box 103 Nobleton, FL 33554	St. Catherine Quarry	22S	21E	2

SUWANNEE

Anderson Contracting Co., Inc. P. O. Box 38 Old Town, FL 32680	Lanier Pit	6S	15E	21
Hatch Enterprises, Inc. Box 238 Branford, FL 32008	Hatch Quarry	6S	14E	16

TAYLOR

Anderson Contracting Co., Inc. P. O. Box 38 Old Town, FL 32680	Cabbage Grove Pit	3S	4E	34
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Limerock Industries, Inc. P. O. Drawer 790 Chiefland, FL 32626	Cabbage Grove No. 2	3S	4E	34
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DOLOMITE**CITRUS**

Colitz Mining Co. (Crystal River Quarries, Inc.) P. O. Box 216 Crystal River, FL 32629	Red Level Mine	17S	16E	36
Dolime Minerals, Inc. (Florida Lime Works, Inc.) P. O. Drawer ARI Bartow, FL 33830	Crystal River Quarry	17S	16E	11,12

JACKSON

Dolomite, Inc. P. O. Box 1586 Marianna, FL 32446	Rocky Creek Mine	3N	9W	18
Florida Lime & Dolomite P. O. Box 681 Marianna, FL 32446	(No Name)	3N	9W	19

LEVY

Florida Rock Industries P. O. Box 227 Gulf Hammock, FL 32639	Gulf Hammock Mine	14S	16E	21,28
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TAYLOR

Dolime Minerals, Inc. P. O. Drawer ARI Bartow, FL 33830	(No Name)	4S	4E	13
Limerock Industries, Inc. P. O. Drawer 790 Chiefland, FL 32626	Cabbage Grove Quarry	4S	4E	2,3

COQUINA**BREVARD**

Brevard Co. Public Works Div.	Kings Park Pit	24S	36E	2
Road and Bridge Department	Valkaria Pit	29S	37E	23
1948 Pineapple Ave.	Rockledge Pit	25S	36E	20
Melbourne, FL 32935	Sarno Pit	27S	36E	22
	Rifle Range Pit	21S	34E	20
	Pluckeybaum Pit	22S	35E	1

REPORT OF INVESTIGATION NO. 88

43

PALM BEACH

Bell Engineering Route 3 7755 Jog Road Lake Worth, FL 33460	Bell Farms Shell Pit	45S	42E	15
Palm Beach Co. Highway Dept.	Lantan Pit	44S	42E	31
2030 Congress Ave. West Palm Beach, FL 33406	Okeechobee Pit	43S	42E	29
Rubin Construction Co. P. O. Box 15065 West Palm Beach, FL 33406	Pebb Pit	44S	42E	6,7

INACTIVE MINERAL PRODUCERS LISTED BY COMMODITY AND COUNTY

Company Name/Address	Mine Name	Mine Location		
		Township	Range	Section
LIMESTONE				
ALACHUA				
Newberry Corporation P. O. Box 1588 Jacksonville, FL	Haile Quarry	9S	17E	13
Williston Shell Rock Co. Box 600 Ocala FL	Buda Quarry Haile Quarry	8S (Location Unknown)	17E	32
BROWARD				
Deerfield Rock Corp. P. O. Box 781 Ft. Lauderdale, FL	Deerfield Quarry	48S	42E	4,9
Florida Material Producers, Inc. P. O. Box 9902 Ft. Lauderdale, FL 33310	Deem Pit	49S	42E	18
Hallandale Rock Corp. Box 781 Ft. Lauderdale, FL	Hallandale Quarry	51S	42E	28
Houdaille Industries, Inc. Houdaille-Duval-Wright Div. P. O. Box 8068 1050 NE 5th Terrace Ft. Lauderdale, FL 33310	Hollywood Quarry Deerfield Quarry	51S 48S	40E 42E	7,18 10
Layne Dredging Co. P. O. Box 5791 Ft. Lauderdale, FL 33310	Decker Quarry	49S	42E	22

BUREAU OF GEOLOGY

Maule Industries, Inc. 5220 Biscayne Blvd. Miami, FL	Prospect Quarry	49S	42E	18
Meekins, Inc. 3500 Pembroke Rd. Hollywood, FL 33021	Monarch Quarry Meekins Quarry	51S 51S	40E 42E	18 20
E. L. Montgomery, Inc. 815 NW 7th Terrace Ft. Lauderdale, FL	Montgomery Quarry	(Location Unknown)		
Oakland Park Rock, Inc. 740 NE 45th Street Ft. Lauderdale, FL 33308	Rhodes Pit	49S	42E	18
Perna Asphalt P. O. Box 959 Deerfield Beach, FL 33441	(No Name)	(Location Unknown)		
Road Rock, Inc. 2700 W. State Road 84 Ft. Lauderdale, FL	Road Rock Quarry	50S	42E	20
L. W. Rozzo, Inc. 4435 SW 26th Street Ft. Lauderdale, FL 33314	(No Name) (No Name) (No Name) (No Name)	48S 50S 49S 50S	42E 42E 42E 43E	4 32 17 24
Finley P. Smith Rt. 1, Box 733 Ft. Lauderdale, FL	(No Name)	48S	42E	4
Snyder Paving Co., Inc. P. O. Box 1199 Ft. Lauderdale, FL	Dania Quarry Ft. Lauderdale Quarry	51S 49S	42E 42E	4 17
Task Corporation 660 North SR 7 Plantation, FL 33317	(No Name)	(Location Unknown)		
R. H. Wright & Son, Inc. Box 781 Ft. Lauderdale, FL	Wright Quarry	(Location Unknown)		
Zinke-Smith, Inc. Box 2004 Pompano Beach, FL	(No Name)	48S	42E	31

CITRUS

B & C Mining Co. P. O. Box 316 Lecanto, FL 32661	Lecanto Pit	19S	18E	22
Carroll Contracting & Ready Mix, Inc. P. O. Drawer 1398 Inverness, FL 32650	Floral City Pit Floral City Pit	20S 20S	20E 21E	24 19

REPORT OF INVESTIGATION NO. 88

45

Florida Lime Works, Inc. P. O. Box 774 Bartow, FL 33830	(No Name)	17S	17E	31
General Portland Cement Co. Box 1528 Tampa, FL	Storey Quarry	20S	19E	35
Gulf Coast Aggregates, Inc. P. O. Box 1686 Crystal River, FL 32629	Gulf Coast Quarry	17S	19E	10
Ocala Limerock Corp. 1013 NE Osceola Ave. Ocala, FL 32670	Rooks-Homosassa	(Location Unknown)		

COLLIER

Leon McCormick & Son, Inc. 3601 Davis Blvd. P. O. Box 326 Naples, FL 33940	Avalon Quarry	50S	25E	13
Ochopee Rock Co., Inc. P. O. Box 154 Naples, FL 33940	Ochopee Quarry	52S	30E	34
Sunniland Limerock Co. Box 1547 Ft. Myers, FL	Sunniland Quarry	48S	30E	29
Ashland-Warren, Inc. P. O. Box 7368 Naples, FL 33941	North Pit South Pit	49S 50S	25E 26E	25 34,35

DADE

E. E. Collins Construction Co. 2175 SW 32nd Ave. Miami FL 33012	Collins Quarry	(Location Unknown)		
Lowell Dunn Co. P. O. Box 2577 Miami, FL 33012	Medley Pit Opalocka Pit Indian Mound Pit	53S 52S 52S	40E 39E 40E	4 11 16
Ideal Crushed Rock Co., Inc. 5500 NW 37th Ave. Hialeah, FL	Dade County Pit	56S	40E	4
T. J. James Construction Co., Inc. 1700 NW 119th Street Miami, FL	James Quarry	(Location Unknown)		
LeHigh Portland Cement Co. Southeastern Division 7370 NW 36th Street Miami, FL 33148	LeHigh Quarry	52S	40E	32,33

BUREAU OF GEOLOGY

Mäule Industries, Inc. 5220 Biscayne Blvd. Miami, FL	Ojus Quarry	52S	42E	5
	Red Road Quarry	53S	40E	Lots 1,2
	Tropical Quarry	54S	40E	22
	Pennsuco Quarry	52S	40E	31,32
Murphy & Mills Corp. 2601 NW 75th Street Miami, FL	(No Name)	53S	41E	2
	(No Name)	51S	42E	32
Naranja Rock Co. P. O. Box 98 Naranja, FL	Naranja Quarry	56S	39E	33,34
Native Stone, Inc. Box 252 Miami, FL	Ball Quarry	(Location Unknown)		
Oolite Rock Co. P. O. Drawer 868 South Miami, FL	Oolite Rock Quarry	54S	40E	23
Peffer Construction Co. Box 185 Shenandoah Station Miami, FL	Hialeah Gardens Quarry	(Location Unknown)		
E. A. Pynchon P. O. Box 1921 North Miami, FL	North Miami Quarry	50S	42E	20
Seminole Rock Products Co. P. O. Box 335 Tamiami Station Miami, FL	Red Road Quarry	53S	41E	31
	Medley Quarry	53S	40E	9,10
Three Bays Improvement Co. (Formerly Hialeah Crushed Stone Co.) 2601 NW 75th St. Miami, FL	Dade County Mine	52S	41E	35
Troup Quarries, Inc. P. O. Box 168 Miami, FL	Kendall Quarry	55S	40E	15
	Perrine Quarry	55S	40E	29

HERNANDO

Brooksville Rock Co., Inc. 605 W. Broad Street Brooksville, FL 33512	Annutteliga Quarry	21S	18E	23,26
Camp Concrete Rock Co. Box 608 Ocala, FL	Gay Plant	22S	19E	6,7
Florida Crushed Stone Co. 303 E. Silver Springs Blvd. P. O. Box 608 Ocala, FL 32670	Lansing Quarry	21S	19E	22

REPORT OF INVESTIGATION NO. 88

47

W. P. McDonald Corp. of
Florida
Box 1256
Lakeland, FL

Conroc Quarry

22S

20E

19

JACKSON

Anderson Contracting Co.
P. O. Box 38
Old Town, FL 32680

Sam Smith Mine

5N

11W

23

Green Valley Lime Co.
P. O. Box 387
Marianna, FL 32446

Marianna Quarry

5N

10W

29

Marjax Company
Marianna, FL

Marjax Quarry

5N

10W

30

West Florida Lime Company
Box 208
Cottandale, FL 32431

Cottandale Quarry

5N

11W

30

LAFAYETTE

Anderson Contracting Co.
P. O. Box 38
Old Town, FL 32680

Gardiner Pit

4S

11E

32

Williston Shell Rock Co.
Box 600
Ocala, FL

Dell Quarry

11S

4E

32

LEE

Central Florida Mining Co.
P. O. Box 4525
North Ft. Myers, FL 33902

North Ft. Myers Pit

43S

25E

5

Jones Contracting Co., Inc.
1233 Gramac Drive
North Ft. Myers, FL 33903

Matlacha Pit

44S

23E

10

Lee-Mar Corp.
Rt. 3, Box 489
Ft. Myers, FL 33901

Lee-Mar Pit

45S

24E

32

Triple C Fill & Paving Co.
General Delivery
LaBelle, FL

Triple C Pit

44S

25E

25

Warren Bros. Co.
P. O. Box 7368
Naples, FL 33940

LeHigh Acres Pit

44S

27E

30

BUREAU OF GEOLOGY

LEVY

Levy County Lime Rock Corp.	Quarry #1	12S	19E	19
Box 194	Quarry #2	12S	19E	25
Williston, FL	Quarry #3	12S	19E	29
Limerock Industries, Inc. P. O. Drawer 790 Chiefland, FL 32626	Vista Pit	12S	14E	19
Charles E. Peacock Williston, FL	Peacock Quarry	(Location Unknown)		
United Limerock Co. P. O. Box 4667 Jacksonville, FL	Williston Quarry	(Location Unknown)		
W & M Construction, Inc. Williston, FL	Raleigh Quarry	12S	18E	24

MARION

City of Ocala 435 NW 2nd Street Ocala, FL	Ocala Quarry	15S	22E	19
W. L. Cobb Construction Co. P. O. Box 11826 5002 E. Hillsborough Ave. Tampa, FL 33610	York Quarry	15S	20E	26
Cummer Inc. of Ocala P. O. Box 1539 Ocala, FL	Kendrick Quarry	14S	21E	24
Cummer Lime & Manufacturing Co. P. O. Box 4640 Jacksonville, FL	Martin Quarry	14S	21E	10,11
Dixie Lime & Stone Co. Rt. 4, Box 363A Ocala, FL 32670	Martin Quarry	14S	21E	11
	Zuber Quarry	14S	21E	13
	LeHigh Quarry	(Location Unknown)		
Dixie Lime Products Co. P. O. Box 598	Plant No. 1 Reddick	(Location Unknown)		
	Plant No. 3 Kendrick	(Location Unknown)		
F & G Enterprises P. O. Box 615 Bellevue, FL 32620	Bellevue Pit	16S	22E	2
	Dallas Pit	17S	23E	30
	Santos Pit	16S	22E	10
Marion County Road Dept. 3330 E. Maricamp Road Ocala, FL 32670	Proctor Pit	17S	23E	30
	Castro Pit	15S	21E	6

MONROE

Leo Haskins 726 Caroline St. Key West, FL	Haskins Rock Pit	(Location Unknown)		
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REPORT OF INVESTIGATION NO. 88

49

Keystone Art Co. 684 NW 7th St. Miami, FL	Windleys Key Quarry	(Location Unknown)			
Charlie Toppino & Sons, Inc. Box 787 Key West, FL 33041	Stock Island Quarry	67S	26E	30	

POLK

Dixie Lime & Stone Co. Rt. 4, Box 363A Ocala, FL 32670	Kathleen Mine	26S	23E	32	
Lakeland Rock Co. P. O. Box 2563 Lakeland, FL 33803	Hampton Quarry	25S	23E	36	
Limerock Minerals P. O. Box 3813 Lakeland, FL 33803	Hampton Mine	25S	23E	22	
Ocala Limerock Corp. P. O. Box 1060 Ocala, FL 32670	Hampton Property Limerock Mine	25S	23E	2	

PINELLAS

Charles Phillips 1307 2nd Ave. SW Largo, FL	Alverton Road Quarry	(Location Unknown)			
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ST. JOHNS

Claussen-Laurence Const. Co. Augusta, GA	Anastasia Quarry	(Location Unknown)			
Phillip McLeod Box 673 St. Augustine, FL	McLeod Quarry	7S	30E	28	
E. B. Meade & Sons Box 677 St. Augustine, FL	Anastasia Quarry	7S	30E	28	

SUMTER

Central Quarries, Inc. P. O. Box 822 Leesburg, FL	Sumterville Quarry	(Location Unknown)			
Florida Rock Industries, Inc. P. O. Box 4677 Jacksonville, FL 32201	Center Hill Quarry	21S	23E	28	
Sumter Lime Products P. O. Box 6 Sumterville, FL	Sumter Quarry	20S	23E	18	

SUWANNEE

Anderson Contracting Co., Inc. P. O. Box 38 Old Town, FL 32680	Mulkey Pit Hall Quarry	6S	15E	21 (Location Unknown)
Florida Rock Industries, Inc. P. O. Box 4667 Jacksonville, FL 32201	Suwannee Quarry	2S	13E	1,2,3, 11,12,13,14
Live Oak Stone Co. P. O. Box 327 Live Oak, FL	Live Oak Quarry			(Location Unknown)
L. J. McCray Const. Co. 429 East Street Lake City, FL 32055	Mulkey Pit	6S	14E	23
Suwannee Limerock Co. Branford, FL	Ralph Quarry	5S	14E	32
S. M. Wall Co. 1650 NE 23rd Blvd. Gainesville, FL 32601	Branford Quarry			(Location Unknown)

TAYLOR

Limerock Industries, Inc. P. O. Drawer 790 Chiefland, FL 32626	Tennile Pit	8S	10E	21
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DOLOMITE

CITRUS

Golden Dolomite Co. P. O. Box 1193 Orlando, FL	Red Level Quarry	17S	16E	25
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LEVY

Dixie Lime Products Co. P. O. Box 578 Ocala, FL	Lebannon Quarry	16S	16E	12
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MANATEE

Bradenton Stone Co. P. O. Box 256 Bradenton, FL	Bradenton Quarry	34S	18E	32
Florida Travertine Co. Oneco, FL	Clark's Quarry	35S	18E	7
Manatee Dolomite Co. P. O. Box 37 Samoset, FL	Minton Quarry	35S	18E	5

REPORT OF INVESTIGATION NO. 88

51

Southern Dolomite Co. P. O. Box 23 Bradenton, FL	Palmetto Quarry	34S	18E	19
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SARASOTA

Florida Dolomite Co. Pembroke, FL	Sarasota Quarry	36S	17E	1
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Venice Dolomite Co. 303 E. Silver Springs Blvd. P. O. Box 367 Ocala, FL 32670	Venice Dolomite	(Location Unknown)		
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COQUINA

PALM BEACH

Belle Glade Rock Co. P. O. Box 37 Northwest Branch Miami, FL	South Bay Quarry	44S	36E	23
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Burnip & Sims Inc. 505 Park Street West Palm Beach, FL	Peanut Island Mine	42S	43E	34
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Driskell & Mayo Jupiter, FL	DuBois Quarry	40S	42E	31
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Handley Construction Co. Airport Road Pahokee, FL	Palm Beach Co. Quarry	(Location Unknown)		
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Palm Beach Co. Highway Dept.	Lantana Rock Pit	45S	42E	2
2030 Congress Ave.	Okeechobee Pit	43S	42E	29
West Palm Beach, FL 33406	Rangeline Pit	45S	41E	2

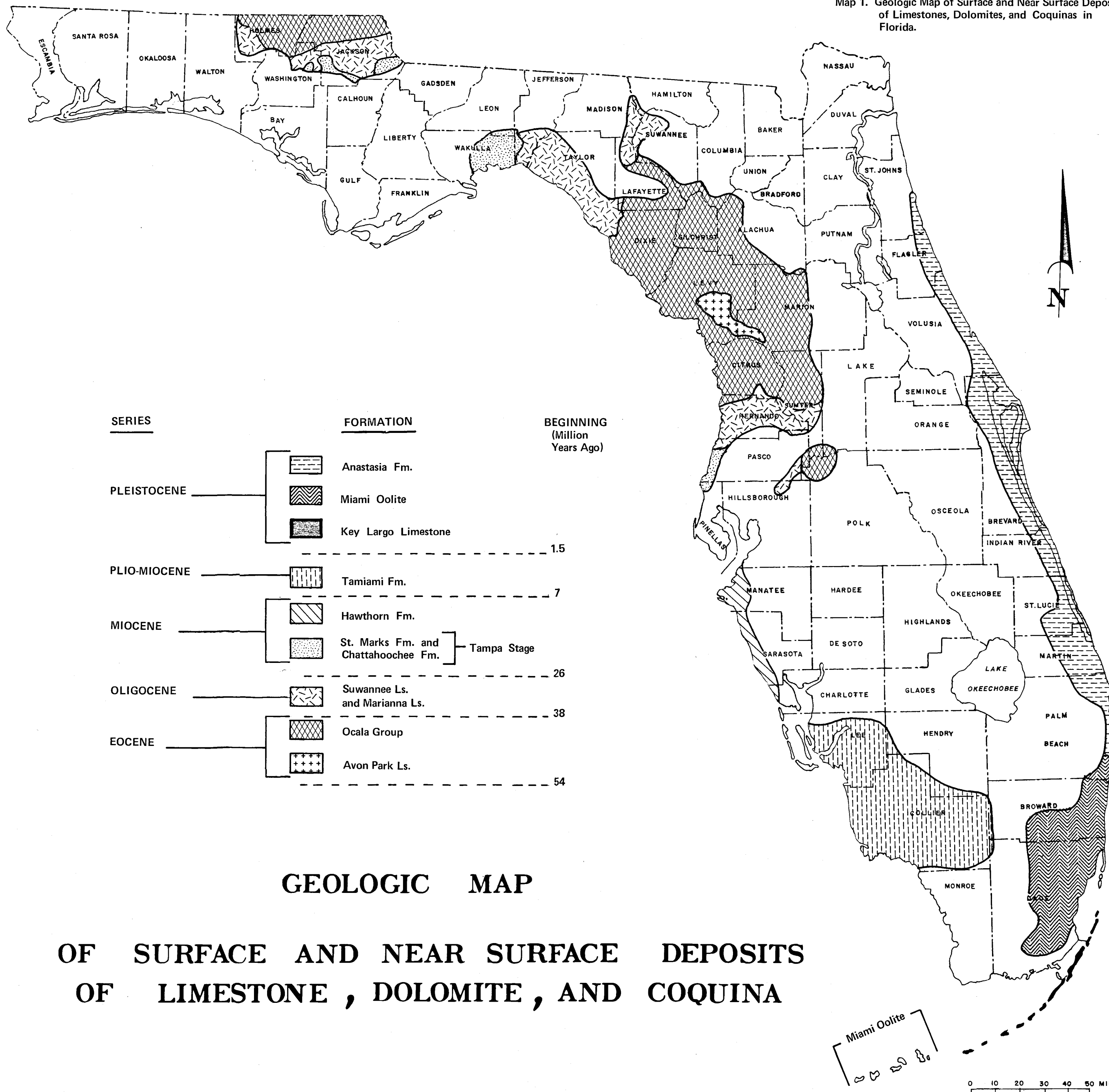
Rubin Construction Co. P. O. Box 15065 West Palm Beach, FL 33406	Burke Trustee Pit	(Location Unknown)		
	Dingwall Pit	(Location Unknown)		
	Rosa Tusa	(Location Unknown)		

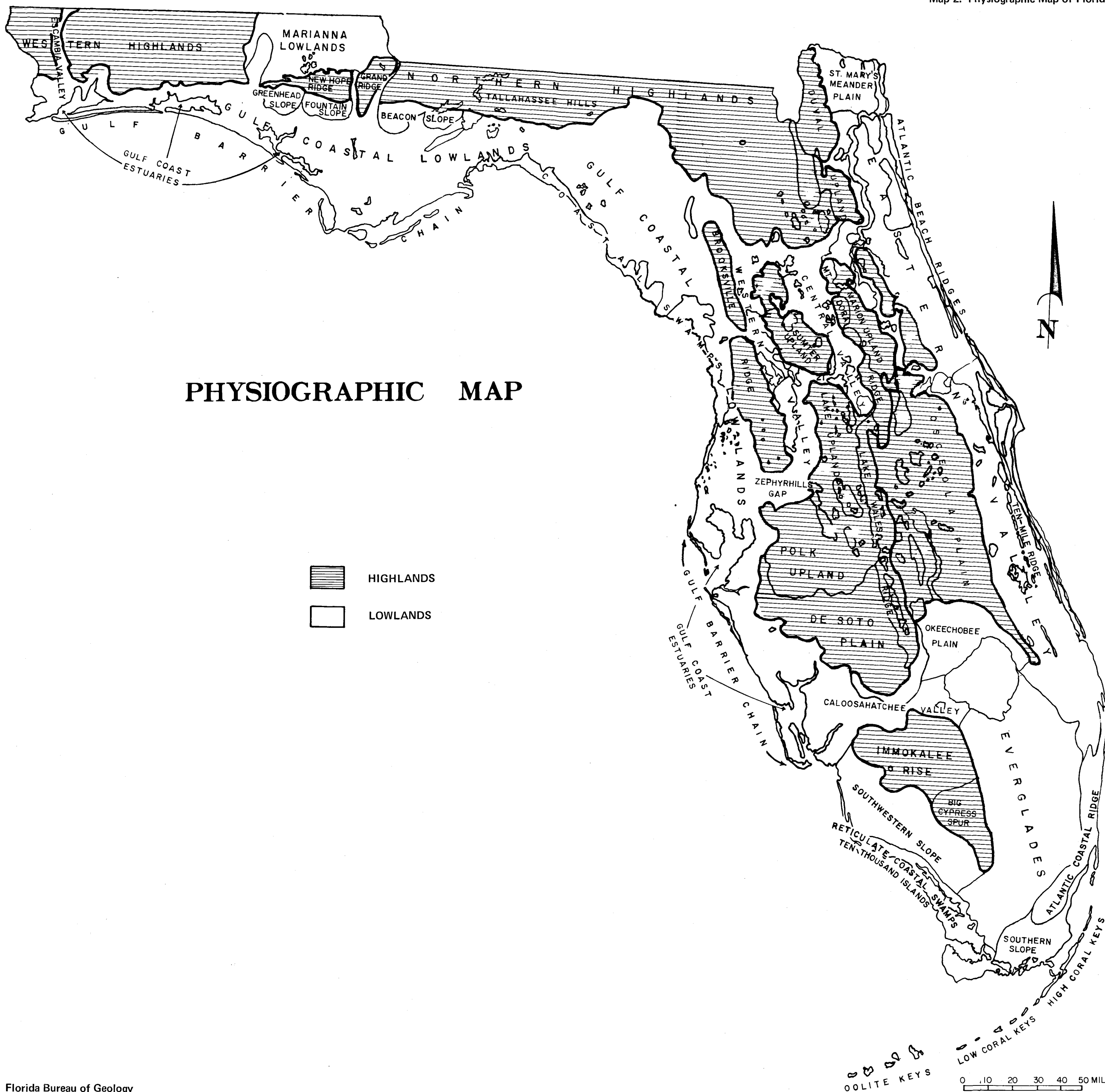
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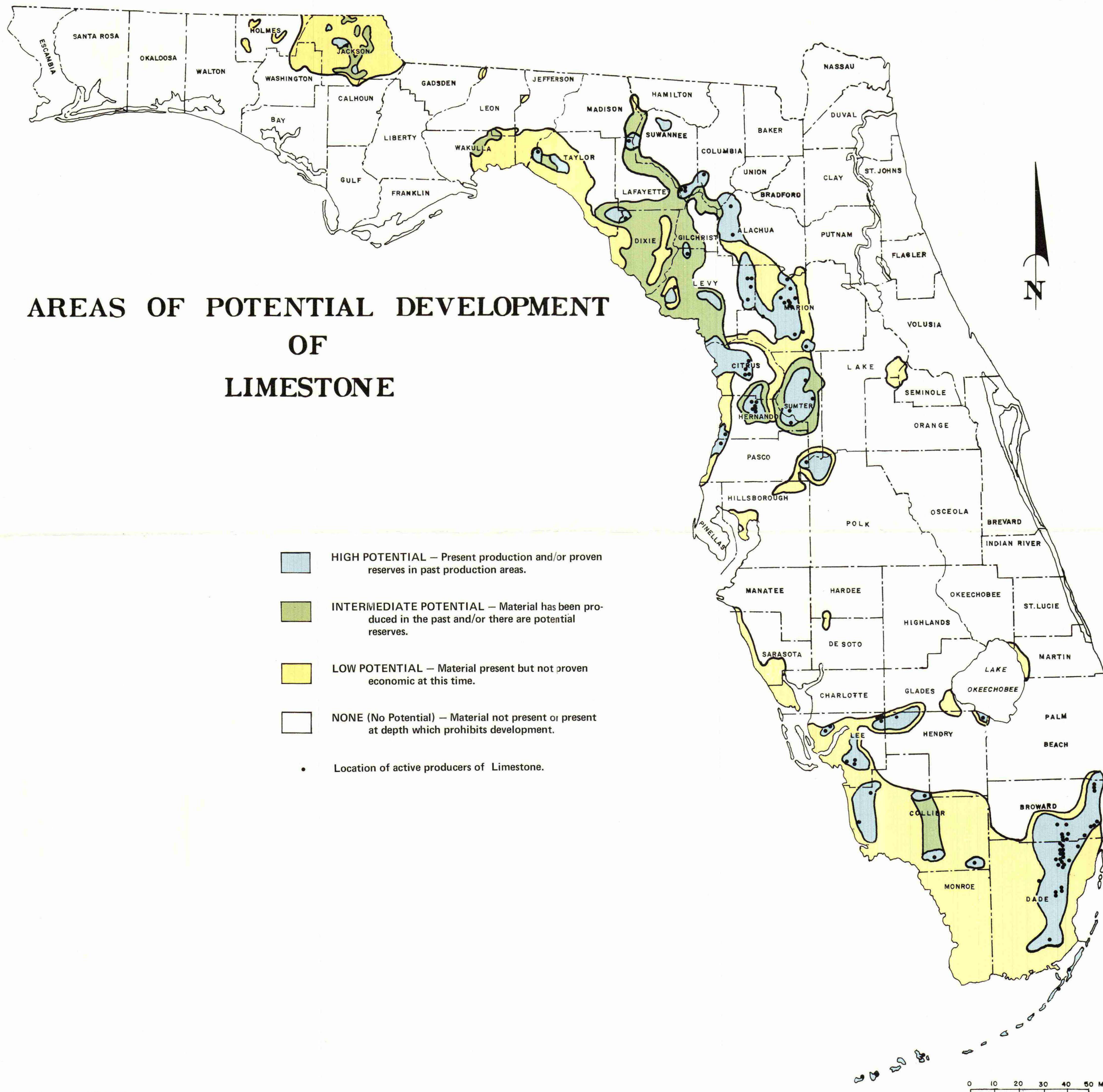
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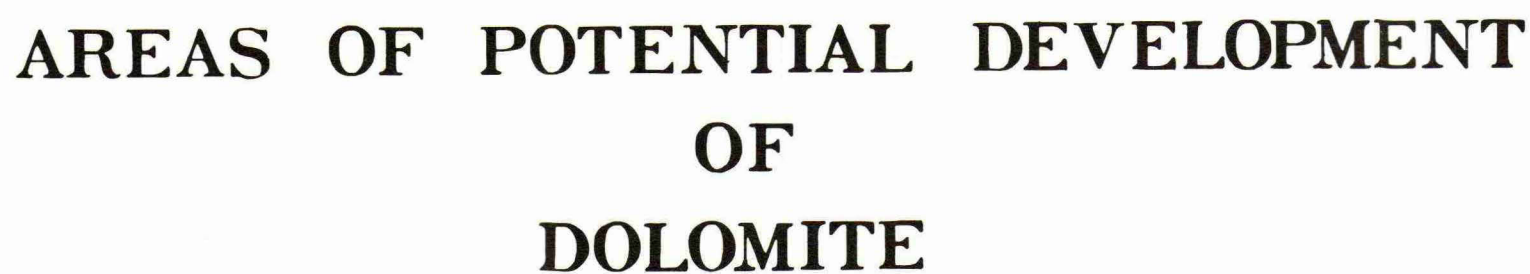
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Map 1. Geologic Map of Surface and Near Surface Deposits of Limestones, Dolomites, and Coquinas in Florida.

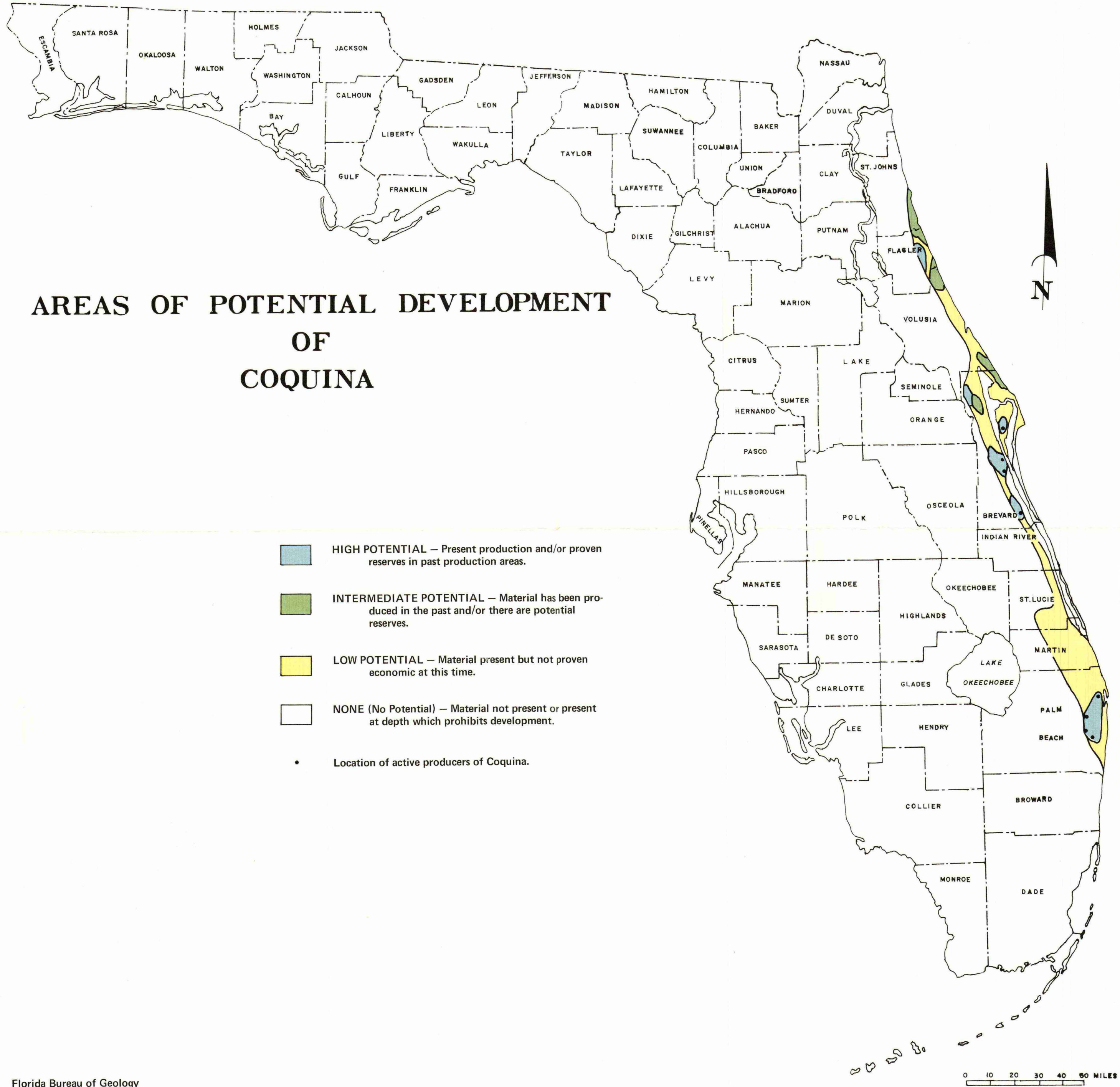








Florida Bureau of Geology



**DEPARTMENT OF NATURAL RESOURCES
BUREAU OF GEOLOGY**

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